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AND OF THE

INSTITUTIONS IN UNION.

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No. 261. FRIDAY, NOVEMBER 20, 1857. Vol. VI.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 20, 1857.

NOTICE TO MEMBERS.

The Council hereby call a Special General Meeting of the Members of the Society, to be held at the House of the Society, on Tuesday, the 1st of December, at seven o'clock.

By Order,
P. LE NEVE FOSTER,
Secretary.

FIRST ORDINARY MEETING.

WEDNESDAY, Nov. 18, 1857.

The First Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 18th inst., Mr. C. Wentworth Dilke, Chairman of the Council, in the chair.

The following Institution has been taken into Union since the last announcement:—

447. West Brompton, Literary and Mutual Improvement Institution.

The CHAIRMAN said:—

Before proceeding to read the address of the Council, it appears to me that I should say a few words as to the reason of my appearance to night as chairman. This is not the time for any discussion on the subject—the meeting to-night, open to strangers, being restricted to hearing the address of the Council. It is, however, known, I presume, to all the members present, that extreme differences of opinion had arisen between the members of the Council and the chairman—on which the chairman was requested to resign. The circumstances will be explained in the Address of the Council. The Council were good enough to intimate their wish that I should accept the office thus vacated. I declined, because I knew that I was wanting in one qualification, at least,—the power of addressing public meetings. I was, however, assured that it was of far more importance at the present moment to have a person in the chair who could attend to the business of the Society, and one known to have abstained, until the last moment, from taking part in the past angry discussions. Therefore it is that I am here, ready as I ever have been to do the work of the Society, and putting my trust in the good feeling of the members, that they will be tolerant of all my deficiencies and support me in maintaining the interests of the Society through its elected officers.

The CHAIRMAN then proceeded to deliver the following

ADDRESS.

In accordance with the Bye-laws of the Society, it is my duty, as Chairman of the Council, to foreshadow to you the views which the Council entertain of the policy which should be pursued by the Society during the present session to further the progress of the Arts, Manufactures, and Commerce, so far as our influence may extend.

The condition of India engrosses the public mind at the present time, and Parliament will doubtless consider the whole policy of its government. With that question the Council would not presume to meddle. But whatever affects the trade and commerce of that great empire and this country comes legitimately within the province of the Society to discuss. It is alleged that the system in force, until within the last quarter of a century, which prohibited any one under a heavy penalty from going to India to settle and embark his capital, still exerts a traditional influence in making it almost impossible, even at the present time, for any one to do so advantageously. It is alleged that the first requisite in developing the productive powers of any country is notoriously wanting in India, and that few, if any, adequate inducements are held out to British capitalists to construct railways, bridges, harbours, and docks, or to invest their money in that country. There is a strong feeling on this point in Manchester and other important seats of British industry. Without passing any judgment on the subject, the Council feel that the Society will be rendering good service by appointing a Committee to correspond with those who may be interested, and to bring before the Society

and the public any useful facts which may be elicited. The Council therefore propose to seek the co-operation of influential persons in the chief manufacturing towns of the country with a view to carry out this object. The Secretary has also been in communication with Dr. Buist, of Bombay, who has kindly undertaken to forward a communication to the Society during the present Session.

The extension of the railway system into India and our colonies within the tropics renders an inquiry into the nature and character of the various woods produced in those countries desirable, in order that a comparison may be instituted between them and those in ordinary use for railway purposes in Europe. It seems, also, desirable to ascertain the most effective and economic means of preserving such materials, when brought into use for sleepers, or any other railway purpose, against the destructive effects of extreme heat and moisture, and the ravages of white ants. It is further important to take measures for ascertaining, on the score of economy in construction, the practicability of extensively adopting in tropical countries the use of iron for railway purposes instead of wood.

The attention of the Council has been called to the reported failure of gutta percha as an insulating material for Electric Telegraphs in India and other hot climates, and it would seem desirable that every effort should be made to discover some new material, capable of resisting high temperatures, which may be adopted as a substitute. A paper by Professor Bleekrode, of Delft, recently published in the Society's *Journal*,* has thrown light upon the class of plants yielding this description of gum. The attention of chemists and manufacturers may well be directed to the importance of rendering these, or similar substances, suitable for use in hot climates. The Dutch Government have seen the importance of getting further information as to the supply of this important material from their colonies, and for this purpose have lately sent there an eminent chemist and naturalist, Professor De Vriese, to make investigations on the spot.

The subject of Indian fibres was ably dealt with by Dr. Royle, in his paper read before the Society last year, but the cost of carriage from the interior to the ports of shipment appears, hitherto, to have prevented their extensive introduction into our markets, though their value was fully proved by the sales at the London Commercial Sale-rooms, in February last.†

The active measures which have been recently taken to construct railways in India, though seriously interfered with by the mutinies, will, it is hoped, soon be renewed, and ultimately be the means of opening up to this country the commerce of the interior, and of affording facilities for the more extensive introduction of British manufactures to the 150,000,000 of inhabitants of that country.

* See vol. v., page 625.

† See *Journal*, vol. v., page 254.

There has always been an intimate connexion between our Colonies and the objects of this Society, and in directing special attention to the subject of India during the Session, the Council would not have it inferred that subjects bearing on general colonial interests will receive less attention than hitherto. It is known that our manufacturers require increased supplies of cotton, wool, and hair, or substitutes for hair, and some of our colonial possessions may supply many new varieties of each, or animals may be acclimatised with this view. It would be extremely advantageous to the colonies, if the example of Mr. Chief Justice Temple, given last year, were more frequently followed, and information in reference to their natural resources and industrial products, were extensively collected by those whose position and influence enable them to do so with facility. The Council will gladly lend their aid in obtaining reports upon the uses and market value of any products that may be forwarded to the Society from any of our colonial possessions; they would be glad to receive samples of some of the finest cabinet woods from Australia and Tasmania, which they believe would, from their remarkable beauty, find a ready sale.

The recent failures in the European vine crops point to the desirability of encouraging the cultivation of the vine in our colonies generally. Considerable progress has already been made at the Cape and in Australia. Some useful suggestion in reference to this subject will be found in a recent number of the *Journal*.*

Late discoveries in Africa have excited much public attention, and a collection of the various kinds of cotton, wool, hair, dyes, vegetable oils, as well as the grain and minerals of that country, would possess peculiar interest. At a time when increased supplies of cotton are so much required, the importance of investigating the resources of a country which is known to be capable of producing this plant in large quantities, can hardly be over-rated. Should a collection of these products be formed, it is highly desirable that, in order to render it commercially useful, the cost of each specimen in bulk at the nearest sea-port should be mentioned, as well as the quantities in which it could be supplied.

In the year 1853, the Council received a communication from the New Zealand Society, in reference to New Zealand flax, placing fifty pounds at the disposal of the Society of Arts, and the Council have not been called upon to award this premium, and they would now direct attention to the offer lately made by the New Zealand government, of prizes amounting

* See page 672, vol. v.

to £4,000, of which particulars were recently published in the Society's *Journal.**

The following are the prizes offered:—

£2,000 to the first person, and £1,000 to the second person who shall, by some process of their own invention, produce from the *Phormium Tenax*, or other fibrous plants indigenous to New Zealand, one hundred tons of merchandise; and £200 to each of the first five persons, other than those entitled to the first and second rewards, who shall by any process, whether of his own invention or not, produce from the *Phormium Tenax*, or other fibrous plants indigenous to New Zealand, twenty-five tons of merchandise.

"The merchandise must be saleable as an article of export from the Colony of New Zealand, and have been produced at a cost not exceeding 75 per cent. of its value at the port of entry from which it is exported; and the process used must be fully made known with a view to the discovery being at once made available to the public."

With reference to this subject, as well as to the general products of this Colony, the Council have arranged for a paper to be read before the Society, during the Session, when it is hoped that some useful information will be given as to the peculiar characteristics of the New Zealand flax, and the present mode of operating upon it, and which may tend to forward the object of the New Zealand Government in offering these premiums.

Having thus touched upon what may be called the foreign policy of the Society, the Council would next direct attention to some subjects of interest nearer home. With reference to the Evening meetings, the papers to be read previously to Christmas, are as follows.†

In addition to these, the Council hope to bring forward, among other subjects of interest, that of noxious trades generally, the recent discoveries in science and their application to the Arts and Manufactures, refuse materials and their reconversion, metropolitan telegraphs and their economical construction, the past and present state of French agriculture, and many others. A further communication on the natural resources and industrial products of British Honduras, is expected from Mr. Chief Justice Temple.

The Council have not lost sight of the important question of the Amendment of the Patent Law, and of the tax which it imposes upon inventors seeking that protection, which tax is absorbed in the general revenue of the country, through the department of stamps and taxes. If any greater fund is to be raised than may be necessary to pay the working expenses of the office, after the large compensations secured by the present Act to the law officers shall have lapsed, all parties are agreed that such surplus ought not to go to the general exchequer, but to the promotion of invention. At the present time, this surplus is many thousands a-year, which have unexpectedly arisen from the reduction of the old patent fees to chaff-wax and others, and this has been carried by an ingenious mode to the credit of the public revenue. Now there are two obvious modes of applying this surplus fund, if we must have a surplus. First, to assist the Mechanics' Institutions with the means of providing a better class of education, and, secondly, to provide proper buildings, not only in the metropolis, but in the provincial seats of manufacture, to exhibit models of patented inventions. In less than five months, 200,000 persons have visited the experimental temporary patent Museum at South Kensington: sufficient proof has been afforded of the interest taken by the public in this collection, to justify the immediate provision of a suitable public building to exhibit patent models. The Council propose, therefore, to re-appoint a Patent Committee to watch this subject, and rescue the surplus fees from the present unfair system of appropriation.

The Council also feel that the Society might render considerable benefit to Art if it would take in hand the equitable adjustment of the law of copyright in Art production. First, by collecting proper information on all matters connected with this important subject and, secondly, by bringing all its influence to bear in order to a thorough settlement of the whole question. As it is, these laws are most unequal, affording protection in some cases and utterly neglecting others, and thus inflicting serious injury on the purchasers of Art as well as upon the artist. Prints and engravings enjoy a tolerable degree of protection under the 8 Geo. 2, extended and enforced under the 7th and 17th of George 3rd, but still requiring much revision. Sculpture enjoys some degree of protection under the 38th of George 3rd, and under the 54th of the same king, as well as some also under the recent Act for the registration of designs. But the painter has no protection, as has been shown but too fully by many recent transactions, as in the injury done to Mr. F. R. Pickersgill, Mr. Ward, and Mr. Linnell. It appears that any person may make and sell a copy of any picture that has passed out of the artist's hands; or even if the copy has been surreptitiously made while the picture was in his possession, he has no means of preventing the sale of it. Moreover, any such copy may be engraved without his consent, and the artist has no remedy, neither can he control the sale: or his picture may be photographed, and either retailed by this means, or by means of engraving from the photograph; so that when once his picture has left his own secure custody, he has no legal means of enforcing any claim he may have reserved as to the right of engraving it, or any protection by which the

* See Vol. v., p. 328.
† See *Journal*, Vol. v., p. 681.

benefits arising from his own mental labour is secured to him.

The proposal made, some years since, for a parcel postage, has not yet been carried out. This is an important question, as affecting the commercial and manufacturing interests of the country, and might form a legitimate subject for discussion, particularly in reference to the circulation of patterns.

The importance of increased facilities for conveying the heavy goods traffic of London, and relieving the present thoroughfares, points to the necessity for opening up new lines of communication; and the drawings which surround this room, show that the Metropolitan Board of Works is actively engaged in the furtherance of this object: the Council of the Society had great pleasure in placing the rooms at the disposal of the Board for this exhibition. Members of the Society will doubtless remember the able paper which was read before them, last session, on the Thames embankment and metropolitan improvements generally, as well as the valuable suggestions offered in another communication with regard to metropolitan railways. The Council have reason to believe that these papers have been the means of drawing special public attention to the subject, and they will still be glad to lend their aid in the important work of rendering the thoroughfares of this metropolis adequate to the requirements of its ever increasing traffic. Other departments of metropolitan improvement, such as water supply, lighting, and improved arrangements for the supply of provisions, may also usefully occupy the attention of the Society.

The recently-published report of Professor Hunt, on the "Mineral Statistics of the United Kingdom,"* naturally suggests the importance of studying the means of economising the use of coal, and of obtaining economical substitutes for it, for the ordinary purposes of heating and lighting. The desirability of economising space in the holds of steam-vessels is also involved in this question, upon which the Council will be glad to receive communications.

The Council have it in contemplation to appoint a Committee to examine into the present state of the law and practice of shipping insurance, as affecting the advancement of naval architecture, and commerce, and the interests of merchants, commanders, and seamen. This Committee might also consider the present classification and registration of ships, with a view to the advancement of the character of our shipping, and the general interests of commerce, as well as the state of the education of seamen, and the means of improving it, both in a moral, scientific, and practical point of view. The nature and bearing of the public and local taxes on shipping, and their influence on the character of our shipping and commerce generally, as well as any points of a general nature in the mechanical arrangements for working, ventilating, and navigating ships which may seem capable of improvement, would naturally occupy the attention of such a Committee.

* See *Journal*, Vol. v., p. 665.

The intimate connexion between Arts, Manufactures, and Commerce, naturally leads to the discussion of questions affecting their precise relation with each other. Thus, certain points of social science and political economy have, from time to time, occupied the attention of the Society, and papers have been read on the international commercial impediments which arise out of fiscal exactions, and diversity of standards of currency, and of weights and measures. During the ensuing session, these and other cognate subjects will probably be brought under consideration, though it may be difficult at this moment to indicate the precise form which they may assume.

The third award of the prize of "a silver goblet, value 100 guineas, containing gold coin to the same amount," will be made, in accordance with the will of the late Dr. Swiney, in January, 1859, and the conditions will be shortly advertised.

The Council desire to draw attention to the special prizes which were announced for competition during the last Session. The first of these consists of a prize of 200 guineas, placed in the hands of the Council by Mr. Henry Johnson, to be awarded for "The best Essay on the present financial position of the country as affected by recent events, in which the principle of a sinking fund should be discussed, and also an investigation made as to the best mode of gradually liquidating the National Debt." The Essays are to be sent to the Society of Arts by the 31st day of December, 1857.

The other two prizes consist of sums of £50 and £20 respectively, which have been placed in the hands of the Council by Sir W. C. Trevelyan, Bart., to be awarded for "The two best and approved Essays on the applications of the Marine Algæ and their products, as food or medicine for man and domestic animals. Competitors must give the results of their original investigations on sea-weeds (especially on the chemistry of their nutrient principles); and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the nutritive species in a state fit for food. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, are to be sent to the Society of Arts by the 31st day of March, 1858.

In reference to the last mentioned prizes, the Council desire to draw attention to the letters from Sir John Bowring and Dr. Macgowan,

which were published in a recent number of the *Journal.**

The Council are happy to draw attention to the benefit which the public is now deriving from the results of the Educational Exhibition, suggested by Mr. Chester, and carried out by the Society in the year 1854, in St. Martin's Hall. The collection then presented to the Council by the exhibitors, has formed the nucleus of the present Educational Exhibition at South Kensington.

It will be remembered that one of the Society's Vice-Presidents has been for some time engaged in preparing a collection of articles and illustrations, designed to familiarise the working classes with the means which science and commerce present for improving their condition as to dwellings, furniture, and household utensils, their food and clothing, and the sanitary considerations involved in their domestic and industrial life. The materials thus got together as the nucleus of an Economic Museum, were some months ago placed by the Council at the disposal of the Committee of the Privy Council on Education, under an impression that, from the explanatory and instructive manner in which they were intended to be labelled and classified, they might suitably form part of the Educational Museum at South Kensington. Many obstacles have hitherto prevented their complete exhibition, particularly the want of available space, Mr. Twining's ill-health, and other unforeseen circumstances; nevertheless, a portion of the food department has been shown on a small scale, so as to give an idea of the kind and amount of usefulness which might ultimately be expected from this and other portions of the collection.

A certain number of illustrations also of model dwellings and a few fittings are exhibited in another part of the building. Other materials are in preparation, and it is to be hoped that a slow, but persevering progress will ultimately realise, either at Kensington or elsewhere, a complete series of illustrations of every-day life, offering to the working classes in an attractive form the kind of instruction they so much require.

The Council have now to make some statements respecting the Examinations and the Board of Examiners.

As the present meeting is not confined to members of the Society of Arts, it is not a meeting for discussion; and, on this ground, the Council had hoped that it would not be necessary, in this address, to enter into any details which might provoke a desire to reply; but that a full statement of all that has occurred, and of all that is proposed by the Council, in reference to the Examinations and the Examiners, might be reserved to the special meeting to which the whole matter must be speedily referred, and the Council have now to announce that the day fixed for that meeting is Tuesday, the 1st of December, at 7 o'clock.

Recent circumstances, however, compel the Council, on this occasion, to enter into the details more fully than had been intended; and, if the inconvenience of being prevented from replying at once to what may be said, is felt by any one, it must be remembered that this course has been forced on the Council, who have no hesitation in saying that they feel themselves to have been entirely misrepresented by their late Chairman.

The plan of Examinations which the Council originally proposed, and which the Conference of the representatives of the Institutes in Union with us unanimously approved of in 1854, was drawn up by Mr. Chester, with whom the Union of Institutes had originated. It was a plan for Examinations, by printed papers, under the authority of the Society of Arts, at such places throughout the Union as could make suitable arrangements for the satisfactory working of the papers.

That plan was intended to be brought into operation in the spring of 1855; but, from causes which had little or no bearing upon the merits of the plan, did not come into effect at that time. In the summer of 1855, Dr. Booth was appointed Chairman of the Council, and brought the plan into operation, but in doing so he introduced into it some important modifications. Of these, by far the most important was the addition of *oral* examination to the original plan of examination by papers, and this combined system of oral and written examination was then tried at a single centre, viz., in this House, in June, 1856. The experiment was successful as far as it went, but the representatives of the Institutes who attended the Conference in June of that year, almost unanimously expressed their opinions that the peculiar wants of our Institutions would be met by no system of examination which was not capable of being brought home to their doors.

In the summer and autumn of 1856, the Council were invited to extend the examinations to various places in the following year, and the Board of Examiners recommended that they should be held, oral and written, at four places, including London. The Council, however, who alone have the data for deciding what the Society of Arts can do, felt themselves unable to accept this advice, and resolved that, in 1857, there should be only two centres of examination, London and Huddersfield, at which places examinations were accordingly held in June last, and the Society and the Institutes in Union are deeply indebted to the Examiners for their very valuable services, which were rendered gratuitously.

Soon afterwards, however, the Council found themselves brought into a position of great embarrassment. They became aware that Dr. Booth, who was at once Chairman of the Council and of

* See page 657, Vol. v.

the Board of Examiners, had in public speeches in different parts of the country, and in published letters during the vacation, led the public to expect that the Society was about to do what the Council had not decided to do, and, more than that, did not think right or expedient, or even possible, to be done. It also appeared that he, without any authority from the Council, and without communicating with the Secretary, had inserted in the Society's *Journal* an advertisement of the forthcoming programme of the Examinations for 1858, with a table of contents, from which it could not but be concluded that the Society had decided to confer the title of "Associate of the Society of Arts" upon those young men who might obtain certain certificates from the Board of Examiners, and also that he had held out to various provincial towns, which he had specified, that the Society would hold oral and written examinations there in the ensuing year. Neither of these points had been brought before the Council. It further appeared that a draft of this programme, *before the Council saw it*, had been sent by Dr. Booth to several persons not of the Council; and letters were received by the Secretary from young men in various towns, stating that they had been informed that the Society had decided to create "Associates."

On the 30th of September, the draft of the proposed programme was sent up from the Board of Examiners to the Council. The Council have since ascertained that this very important document—which assumed the creation of "Associates"—which specified five places at which the Council were to hold oral and written examinations in 1858—and which provided for the examination of the pupils of commercial schools, (*though the Bye-law which was proposed to carry this out had been rejected by the General Meeting to which it was referred*), had been sent to the examiners in print, without any intimation of the gravity of those points, and had only once been before a meeting of the Board, which meeting was held on September 30th, (the day the draft was forwarded to the Council), and consisted of only four examiners, including Dr. Booth, just one-tenth part of the Board.

This programme came before the Council at their first meeting after the vacation, viz., on the 30th of September last, as stated above. Dr. Booth and nine other members of the Council were present.* Exception was immediately taken to the Chairman's proceedings, previously alluded to, as embarrassing to the Council, and he admitted that he had acted inadvertently. Objections to the proposed creation of "Associates" were very generally expressed. It was thought wholly unsuitable to the character of the Society, and likely to bring ridicule upon those who should bestow, and upon those who should bear, the title. No member of the Council but Dr. Booth defended it. He stated that the system of Examinations was, in his judgment, the only thing left to the Society to do; and that the time had gone by in which it could usefully promote the encouragement of Arts, Manufactures, and Commerce. It is needless to say that this sentiment was not echoed in the Council. After considerable discussion, it was resolved that a special meeting of the Council should be summoned for the further consideration of the "programme," particularly with reference to the questions of Associates and of centres of oral and written examination. That meeting was held on the 8th of October. Dr. Booth was again in the chair, and ten other members were present.*

Dr. Booth withdrew the proposal of Associates; and, after a very long discussion, it was unanimously resolved to request the Board of Examiners to explain to the Council by what means the Board proposed to carry out the plan of oral and written Examinations, at five centres, in 1858; and to furnish a detailed statement of the probable cost.

On the 28th of October the Council met to receive the Examiners' report. There were present Dr. Booth in the chair, and fourteen other members, an unusually large number.† A very full and long discussion occupied almost all the evening; and at length the following resolution was carried by a majority of 12 to 1, Dr. Booth being the only dissentient:—

"The Council having fully considered the subject of oral and written Examinations, and the report of the Board of Examiners thereon, are of opinion that oral Examinations cannot be satisfactorily conducted by this Society at four centres besides London, simultaneously."

The main reasons for the adoption of this resolution were—1st, The expense of sending out the requisite number of Boards of Examiners to great distances from London; 2nd, The impossibility of procuring the services of so many Examiners of equal authority, certain to give uniform judgments, at one time in different and distant places; and 3rd, The very small extent to which even these five centres could supply

* Present:—Rev. Dr. Booth in the chair, Mr. F. Bennoch, Mr. Harry Chester, Mr. Joseph Glynn, Mr. Peter Graham, Mr. Matthew Marshall, Mr. J. C. Macdonald, Professor Edward Solly, Mr. G. F. Wilson, and Mr. Thomas Winkworth.

* Present:—Rev. Dr. Booth in the chair, Mr. Bennoch, Mr. Chester, Mr. J. Griffith Frith, Mr. James Glaisher, Mr. Peter Graham, Mr. Marshall, Mr. Macdonald, Colonel W. H. Sykes, Mr. Wilson, and Mr. Winkworth.

† Present:—Rev. Dr. Booth in the chair; Mr. Bennoch, Mr. Chester, Mr. Henry Cole, Mr. C. Wentworth Dilke, Mr. Frith, Mr. Glaisher, Mr. Glynn, Mr. Peter Graham, Mr. W. Fairbairn, Mr. W. Hawes, Mr. Macdonald, Mr. Marshall, Mr. Wilson, and Mr. Winkworth.

the wants of the Institutes which are scattered all over the United Kingdom.

It was then resolved that the foregoing resolution be communicated to the Board of Examiners, and that they be requested to prepare a scheme for examination by papers only. With this request Dr. Booth advised the Examiners not to comply; and they declined compliance, alleging that they were going "out of office within a week from this time" (Nov. 4th), to use the words of their own resolution.

On the 5th inst. the Council met, by special summons from the chairman, to consider the following resolution, "and for the further consideration of the programme." The proposed resolution was as follows:—

"That the subscriptions received from the Mechanics' and other Institutions in union with the Society of Arts, either directly or indirectly through their presidents or other officers, be from this present Michaelmas set apart from the ordinary income of this society, and be called the 'Institution Fund.' That all necessary expenses incurred in the management and organisation of the examinations, or other measures for the benefit of the Mechanics' Institutions, be defrayed out of this fund. That a committee, selected from the Council and Board of Examiners, be charged with the administration of it; and that a detailed audited account of the income and expenditure be published annually, in November, and furnished to every Institution in union."

There were present, Dr. Booth in the chair, and ten other members.* When the Chairman rose to move his resolution, he was met *in limine* by the objection that it was at variance with the charter, and could not be proposed. After all the members present had shown their concurrence in this objection, and it had been much discussed, Dr. Booth was asked whether he would not withdraw his resolution. He declined to withdraw it, and it was then voted, Dr. Booth alone dissentient, that the resolution was illegal and could not be put. A protracted and painful discussion ensued, in the course of which Dr. Booth avowed that he took no interest in any of the Society's objects except the Examinations; and at last, on the grounds which have been now stated, and for other reasons stated to Dr. Booth at the meeting, a requisition, signed by every member present, was handed to the chairman, requesting him to resign the chair. The meeting was then adjourned to the following day.

On the 6th instant there were present seven members,† the members absent on the 5th having been specially summoned to the adjourned meeting. The meeting being by adjournment, the special business for it was "the further consideration of the programme." Any matter, therefore, that the programme contained was properly before the meeting. The Board of Examiners was a part of the programme. The meeting was, therefore, fully competent to deal with that subject. The attention of the Council was called to the constitution of the Board of Examiners in reference to the *new* Bye-laws which were then about to be brought into operation *for the first time on the 11th inst.* Portions of the Bye-laws relating to the Board were shown to be clearly illegal. They constituted the Board an independent body, remaining in office when every other officer, from the president downwards, goes out of office; fixing their own number, which the Council have no power to alter; nominating themselves, the Council having no power of nomination but only of rejection of individuals; choosing their own chairman, and giving to him, who need not even be a member of the Society of Arts, a right to attend at every meeting of the Council. The Society need not be informed that the Charter vests the absolute control of the Society's affairs in the Council, and that no bye-law is valid in so far as it contravenes the Charter.

The Council were aware that the Board of Examiners, at its last meeting, had settled a list of *proposed* Examiners, which was to be subjected to the ballot of the existing members of the Board on the 11th instant. That list contained 63 names, which, however, might have been reduced on the ballot. If the meeting on the 11th had taken place, the Council could not have altered the number of Examiners sent up to it, and every gentleman who was appointed would have been appointed on an illegal basis, and would have been in a false position. The Board could meet on the 11th, under the Bye-laws, only to nominate their successors, and then to expire; and the Council thought it to be their duty to take care that the successors were not appointed until the Society had had an opportunity of bringing the bye-laws into harmony with the Charter. That opportunity could not be given until a sub-committee had been enabled to re-cast them, and until the time prescribed for the holding of special meetings had elapsed. The Council, therefore, took the only course that was open to them. The existing Board of Examiners was within a few days of its termination, and could only meet to do that which would be illegal and embarrassing to the Council and to the future Board. The Council, therefore, thought it necessary to inform the Examiners that the meeting could not be held.

On Nov. 11th the Council, specially summoned, again met, eleven in number,* and unani-

* Present:—Rev. Dr. Booth in the chair, Mr. Chester, Mr. Cole, Mr. Dilke, Mr. Peter Graham, Mr. Hawes, Mr. Macdonald, Mr. Marshall, Mr. T. Twining, Mr. Wilson, and Mr. Winkworth.

† Adjourned Meeting. Present:—Mr. Dilke, in the chair; Mr. Chester, Mr. Cole, Mr. Hawes, Mr. Macdonald, Mr. Marshall, and Mr. Twining.

* Present:—Mr. Chester, Mr. Cole, Mr. Dilke, Mr. Frith, Mr. Glaisher, Mr. Glynn, Mr. Hawes, Mr. Macdonald, Mr. Twining, Mr. Wilson, and Mr. Winkworth. Mr. Cole in the chair, *pro tem.* Mr. Dilke was elected Chairman, and took the chair.

mously and by resolution, confirmed the proceedings of the previous meeting.

The Council have never entertained the notion of suppressing the Board of Examiners, or of discontinuing the examinations, or of connecting them with the Government. The Council are about to put them upon a footing which will render them capable of being extended to any degree that the Institutes in union may require. The pupils of commercial schools will no longer be admitted to the Examinations which are designed for the Institutes united to us. By what we now propose, the growth of local authority in education will be developed; and it may be hoped that out of these measures may grow an important incorporation of Institutes, based on local authority, and capable of meeting exactly their wants in regard to education. The amended programme for the examinations of 1858 will be published with the least possible delay. The Prize Fund for 1858 will take effect over the whole range of the Union, and may, therefore, with advantage be large. The Council will be happy to receive contributions to this fund.

The Council are strongly of opinion that, while the incidental business of the Examiners should be managed by the Council and their officers, and not thrown on the Examiners, those gentlemen should not any longer be asked to render their valuable services in the real work of examination without a fair honorarium.

In conclusion, it becomes the pleasing duty of the Council to announce the medals that have been awarded during the last Session, and in doing so they desire not only to convey the thanks of the Society to the gentlemen whose papers have been deemed worthy of this special mark of recognition, but also to acknowledge the obligation which the Society is under to the authors of other interesting communications which have been brought under its notice both at the evening meetings and in the columns of the *Journal.*

The medals awarded at the close of the last Session were then presented.

The Secretary announced that, at the Meeting on Wednesday, the 25th inst., the following Paper would be read:—"On the Composition and Relative Value of the Food Grains of India," by Dr. Forbes Watson. On this evening Dr. Lyon Playfair, C.B., F.R.S., will preside.

PAPER DUTIES.

The intention of the excise on paper was that it should be an equal duty on all paper, according to weight, and without reference to the purpose to which such paper is to be applied. In all manufactures from paper, it is manifest that there will be more or less waste: these manufactures would naturally, for the most part, be carried on after the paper has left the mill, and there would be a duty paid upon the waste. The duty is levied to get as much revenue as possible, and without reference to the value of the paper, much less to the value that may be conferred on it by any additional process; there is, therefore, no inconsistency in taxing the waste, any more than in taxing the paper used in any manufacture. But when such manufacture is carried on at a paper mill, the waste is cut away before the paper is charged, and pays no duty: this is strictly according to law, for the law requires only that what goes out of the mill should be charged,—but it is manifestly an interference with the freedom of manufacture, that an envelope-maker (for instance) who makes envelopes at his house should pay a tax which is avoided by the owner of a paper mill; the effect, of course, will be to give the large capitalist not only the advantage of his capital, to which he is fairly entitled, but to place on the small envelope-maker a burden of taxation from which the mill-owner is exempt.

Printing at the paper-mills stands exactly in the same position as making envelopes there; but this has generally been prohibited by the Board of Inland Revenue, and it is even required that a mill for staining paper shall be a certain distance from one belonging to the same owner where paper is made,—though there is not a word in the Act to support this exercise of authority, or to prevent the paper from being printed or stained at the paper-mill, *and charged after it is printed.* Permission to do this has occasionally been granted as a favour: some are of opinion that it may be claimed as a right, and that, if a seizure were made in consequence, and referred to the Court of Exchequer, judgment would be given for the defendant.

Another anomaly is the taxing articles exactly like those which are untaxed, so that the taxed one is driven out of the market. The paper which was formerly used for sheathing ships, and which is still used for roofing, differs but little in its character from felt; and yet the latter only is untaxed.

It appears that the principal inequalities in the present mode of levying the paper duty are as follows:—

Jacquard loom cards, which when done with are still of some value, receive a drawback.

The paper used in making pots, which is destroyed, receives no drawback.

There is no duty charged on Florentine buttons made in the mill, and, of course, there is no duty on the waste.

A duty is charged on the button board to be made into buttons elsewhere, and there is no drawback upon the waste.

Gun waddings differ from Florentine buttons only in having white paper pasted over the brown board, but, unlike Florentine buttons, gun waddings pay no duty, and are smuggled among the buttons to the detriment of the fair trader who pays his duty.

Jacquard cards already pierced pay no customs duty. Jacquard cards not pierced pay customs duty of $2\frac{1}{2}$d. per lb. Cards fit for boxes pay customs duty of $2\frac{1}{2}$d. per lb.

Boxes ready made pay only ten per cent. *ad valorem.*

The following correspondence has taken place between the Lords Commissioners of Her Majesty's Treasury, and Mr. J. Scott, a maker of envelopes:—

The humble Memorial of John Scott, of Charlotte-street, Blackfriars-road, Envelope-maker,

Showeth,—

That your Memorialist is a maker of envelopes, which he cuts from paper manufactured by another person; that in the process of cutting there is a considerable waste of paper; that this waste is of value only for the purpose of being re-made into paper, for which purpose your Memorialist sells it at £19 per ton; and that the duty on this sum, £14 14s., is a duty from which the envelope-maker who is also a mill-owner is exempt, as his paper is not

charged till it is made into envelopes, and the waste is thus returned to the mill without the payment of duty.

That your Memorialist, feeling himself aggrieved by this unfair competition, appealed to the Board of Inland Revenue for redress, but without effect, as is set forth in the following correspondence.

No. 1.—(TO THE BOARD.)

That your Memorialist is emboldened to ask for relief from this unfair pressure by a consideration of the following facts:—

1. That the makers of pasteboard, though legally chargeable with duty on the paste, and placed under the supervision of the Excise to be so charged, are allowed, for the most part, to escape payment of that duty.

2. That even in the mills, certain small articles, such as Florentine buttons, are exempted from duty, though no such exemption is laid down by the Act of Parliament.

3. That a drawback is given on the cards used in Jacquard looms, and that this too is a privilege not conferred by the Act.

That it, therefore, appears that it is the practice to temper the severity of the Excise on paper by judicious exemptions.

That in none of the above instances is the exempted party suffering from so unfair a competition as that described by your Memorialist in his own case.

Your Memorialist, therefore, prays that your Honourable Board will grant him a drawback on the waste cut from his envelopes.

No. 2.—(FROM THE BOARD.)

Jan. 21, 1857.

SIR,—The Board of Inland Revenue have now carefully considered the memorial you recently addressed to them, and they desire me to say that they see so much difficulty, as well as danger to the revenue, in the way of an extension of the indulgence to which you refer, to envelope-makers who are not paper-makers, that they cannot consent to give effect to your wishes in this respect.

No. 3.—(TO THE BOARD.)

[EXTRACT.] March 14th, 1857.

I confess I do not see the difficulty of making such arrangements as would prevent fraud on the revenue. I sell my waste to a paper-maker, and it would be very easy for me to arrange that I should deliver it in the presence of the supervisor, who might either give me an order for the drawback, or deduct the amount from the mill-owner's account, with whom I could make my arrangements.

With such a plan I do not see how the envelope-maker could succeed in the commission of a fraud,—nay he would have much less chance of doing so than the paper-makers themselves.

I therefore respectfully request you to have the kindness to reconsider my petition, and to take into consideration the suggestions I now make.

No. 4.—(FROM THE BOARD.)

[EXTRACT.] March 28th, 1857.

After a careful reconsideration of the whole subject, the Board are unable to satisfy themselves that the concession in question could be granted with safety to the revenue.

Your Memorialist, whilst acknowledging the courtesy of the Board, complains that their refusal is not accompanied by any specific reason. The principle of giving drawbacks not authorised by the Act of Parliament, having been once admitted, it becomes the duty of those who have the power to grant them, to examine every case presented to them, and not to refuse any claim which is founded on a grievance equal to any which has been previously redressed, unless it can be shown that such previously redressed grievance can be redressed with less danger of fraud on the revenue than would accrue from the entertainment of the subsequent claim.

* * * * * *

Your Memorialist, therefore, prays that your Lordships will grant him a drawback on the waste of his envelopes, or, failing this, that you will call upon the Board of Inland Revenue to explain why such drawback would lead to a fraud on the revenue, so that your Memorialist may have the opportunity of stating to your Lordships the reasons why he thinks such a position untenable.

I have the honour to be, My Lords,

Your Lordships' obedient Servant,

JOHN SCOTT.

(*The Treasury in reply.*)

June 17th, 1857.

SIR,—With reference to your application, requesting that the drawback of the duty may be allowed on the waste cuttings of paper used by you in making envelopes, I am directed by the Lords Commissioners of Her Majesty's Treasury to inform you that the law has made no provision for a return of duty in such cases, and My Lords do not think it would be expedient to comply with your application.

I am to observe, with reference to the case of envelope makers who are also mill-owners, that their envelopes are made from paper before the duty has been charged upon it, and under the supervision of the surveying officers of the Excise; no claim, therefore, arises with respect to the cuttings,—as they are re-manufactured without leaving the premises, the revenue is not exposed to risk. I am, Sir, your obedient servant,

JAMES WILSON.

(*To the Treasury.*)

August 1st, 1857.

MY LORDS,—I beg to acknowledge the receipt of your letter, in reply to my memorial praying for—

A drawback on the waste of my envelopes
or, That the Board of Inland Revenue should be called on to show why they consider that my proposal would endanger the revenue.

In reply, you state,

1st. That the law makes no provision for the drawback which I request.

2nd. That the mill-made envelopes are cut before they are charged, and are, therefore, not liable to the duty on the waste.

3rd. That the revenue is not exposed to risk by this advantage possessed by the mill-owning envelope-maker.

The first two of these statements were made in my Memorial, and the third was implied in it.

I grounded my request on the fact that in other cases, which I specified, you had given a drawback for which no provision had been made by law.

The very grievance of which I complain, is the exemption of the mill-owner from a duty on the waste; no doubt the exemption is perfectly legal, but the right of manufacturing envelopes in the paper mills converts the tax which the Legislature intended to be on the raw material into one merely on the manufactured article, while the heavier tax remains upon the domestic envelope-maker.

Nor is there any limit by law to the amount of wholesale manufacture which may thus be carried on with a differential duty in its favour. A wholesale publisher may print and bind his books at the mill without any compensating inconvenience, except that he must pay duty on the ink, paste, and string employed in printing and binding. It is true that, as yet, you put hindrances in the way of such an establishment; but I cannot find in the Paper Duty Act any restriction other than that which I have named.

You say that by the privilege thus enjoyed the revenue is not exposed to risk. No one could suppose that the paper sent out will not pay duty; I submit, however, that if the revenue be really entitled to a duty on the waste, it is exposed, not to risk, but to positive loss when that duty is not paid,—and that, if the revenue be not entitled to this duty in the case of a mill-owner, it is an act of spoliation to take it from me.

I have already pointed out that your Lordships do not consider yourselves prevented from granting a drawback by the absence of any legal provision for such drawback, and I submit that the only conclusive reason for denying my request would be a well-grounded fear of fraud.

I have submitted a plan, which, as it appears to me, would obviate any attempt at fraud, and my request was, that if you did not at once concede the drawback in my case, you would call on the Board of Inland Revenue to

explain their reasons for thinking it necessary to deny it, I submit that the injustice of the present state of things is so clear, that the necessity for such injustice ought to be made equally clear. This part of my request you have ignored. I therefore again call your attention to it, and submit that if you persist in refusing to grant this portion of my prayer, it will appear that the reason for denying my second request is the justice of the first.

I have, &c.,
JOHN SCOTT.

(*From the Treasury.*)

October 13, 1857.

Sir,—I am directed by the Lords Commissioners of Her Majesty's Treasury to inform you that, since the receipt of your further application of the 1st of August, My Lords have been in communication with the Board of Inland Revenue, for the purpose of seeing whether regulations might not be framed under which the concession for which you apply might be made without serious risk to the revenue; and My Lords have given authority to the Board of Inland Revenue to pay drawback of duty charged on waste cuttings of paper made into envelopes, on proof, to the satisfaction of the commissioners, that the cuttings have been reduced to pulp at a paper-mill, or otherwise destroyed.

I am, Sir, your obedient Servant,
W. TREVELYAN.

Mr. J. Scott, 39, Charlotte-street, Blackfriars.

The following has since been issued:—

GENERAL ORDER.

Inland Revenue Office, Somerset-house, London, October 28th, 1857.

In pursuance of directions from the Lords Commissioners of Her Majesty's Treasury, dated the 13th inst.; Ordered,—

That drawback of the duty, charged on the waste cuttings of paper made into envelopes, be allowed under the following regulations, viz.—

The paper from which the envelopes were made, must not have been previously used or prepared for any other purpose.

On notice in writing being given by the envelope-maker to the proper officer, the latter must attend at the premises of the former, and examine the cuttings (observing that they are really those from envelopes, which may be known by their curved and angular form) and see them packed in bags and weighed. He must enter the particulars in a Scheme in his Beer Book, showing the gross weight and the tare of each bag, and the net weight entitled to drawback.

The cuttings must be sent to a paper-mill where paper is *not* cut into forms for envelopes, and must be there reduced to pulp or otherwise destroyed; and the officer must forward to the officer at such mill, an advice letter containing an account of the gross weight, the tare, and the net weight of each bag.

On the arrival of the cuttings at the mill, the paper-maker must give the officer thereof forty-eight hours' notice in writing, in order that he may attend to weigh and examine the cuttings; and, if they agree with the letter of advice, he must see them put into a beating engine, boiler, or other vessel, and saturated with water, and thereupon grant a certificate *in duplicate* that the cuttings have been received, which certificates must be countersigned by his supervisor, who will forward one of them to the officer of the station, and the other to the collector of the collection, from which the cuttings were sent.

On such certificate being received by the officer, he must compare it with the particulars entered in his book, and deliver it to the envelope-maker, who, on producing it to the collector and making declaration before him in the prescribed form, will be paid the amount of the drawback.

Forms of the certificate and declaration may be had on application to the storekeeper.

Supervisors must embrace every opportunity of weighing envelope-cuttings before and after their removal.

If any envelope-maker shall infringe these regulations, to the prejudice of the revenue, this indulgence will be withdrawn from him.

By the Board,
THOMAS DOBSON.

SOUTH KENSINGTON MUSEUM.

During the week ending 14th November, 1857, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,403; on Monday and Tuesday (free evenings), 3,852. On the three students' days (admission to the public 6d.), 500. One students' evening, Wednesday, 134. Total, 6,889.

Home Correspondence.

LECTURES AT MECHANICS' INSTITUTES.

Sir,—At the distribution of prizes of the East Lancashire Institutional Union a short time since, the Lord Bishop of Manchester, who presided on the occasion, is reported to have said:—"As the vain, feeble, and unsatisfactory support of lectures was rapidly giving way." This re-echoes a statement in the Annual Report of the Lancashire and Cheshire Association of Mechanics' Institutes, that in the large towns of the Northern and Midland Counties lectures were a complete failure. As agent and lecturer of the Yorkshire Union, comprising 130 Mechanics' Institutes, I delivered no fewer than 113 lectures during the last winter season, and may, therefore, be presumed to have some experience on this subject. I certainly cannot speak of the success, or want of success, which lectures may have met with in Lancashire and Cheshire, or what kind of lectures may have helped to produce the complete failure so confidently alluded to. As far, however, as Yorkshire may be considered a northern county, and it certainly presents the fairest specimens of successful Mechanics' Institutes, I have no hesitation in giving the statement I have referred to the most direct contradiction. So far from being a failure, lectures are better appreciated than ever they were. In the majority of instances I have met with very good attendances, and, what is more satisfactory, attentive listeners of all classes, while I have endeavoured to convey information, chiefly of a scientific character, in popular language made clear by homely illustrations, and I have reason to believe that they have had a good effect upon the members of many of the Yorkshire Institutes.

At the soirée of the Leeds Mechanics' Institute, Lord Brougham made some excellent observations on the value of lectures, although his lordship appeared to me to give undue preference to a continuous course over what he facetiously styled sporadic lectures. This may be very true if the hearers constituted a class for the study of some particular department of science or literature, but for a Mechanics' Institute such a course is simply impossible. For a miscellaneous audience, composed of persons varying in sex, age, condition, habits, and inclinations, I find the most successful lecture to be one which applies scientific knowledge to the affairs of every-day life, which incites to study by pointing out the advantages to be gained by it, which is rather suggestive than instructive, and the tendency of which is to stimulate application in the classes and recourse to the library. In this light, lectures are the most valuable and important aid to the operations of a Mechanics' Institute, and they have this further advantage, that they are often the only means of making the existence of the Institute known to the inhabitants of the locality.

It is sometimes a matter of complaint that lectures are

not pecuniarily successful owing to members being admitted free. Allow me to suggest to managing committees that this difficulty might be, in a great measure, obviated by canvassing the inhabitants generally to take tickets for a course of lectures, varying, of course, in number according to circumstances. They would then be enabled to make arrangements accordingly. In several instances such a plan has been pursued with great success.

I am, &c.,

BARNETT BLAKE.

Mechanics' Institute, Leeds.

Proceedings of Institutions.

HERTFORD.—The twenty-sixth annual report of the proceedings of the Literary and Scientific Institution states that, although there appears a balance against the Institution in the treasurer's account, yet the successful working of the Society since the last report, affords the committee great satisfaction. There are two or three items of expenditure which the committee have felt it necessary to incur, which have caused the unusual reduction of the Society's funds. The committee have to record their deep regret at the loss which the Institution sustained in the death of their late president, Earl Cowper. The vacant office was offered to, and accepted by the Marquess Townshend. The question of reviving the discussions during the winter months was brought under the consideration of the committee; but it was thought desirable to try the experiment of holding in lieu thereof monthly conversaziones, at which papers upon various branches of Science and Art, and other subjects of general interest, should be read and conversed upon; and these meetings have proved completely successful. The committee believe that, by continuing these at a future time, they will be promoting one of the best objects of the Institution, namely, the discussion of many subjects of an interesting and instructive character, to the gratification and advantage of those who take part in them, and they recommend that these important auxiliaries to the usefulness of the Society be renewed during the winter months.

RICHMOND.—In the last report of the Parochial Library and Reading-room, the Committee state that this Institution has during the past year progressed satisfactorily in forwarding the objects for which it was founded. Some additional papers have been added to the reading-room, and it has maintained its last year's average of attendance. A new bookcase has been placed in the library, filling up one entire side of the room; and twelve pounds have been most judiciously expended for the Society, by Mr. Bohn, in the purchase of standard works; this, in addition to the handsome donation of ten pound's worth of his own publications, and a large number of volumes presented by J. C. Selwyn, Esq., Q.C., and the executors of the late H. Leatham, Esq., have considerably augmented its interest and usefulness. In addition to which, a large balance from the proceeds of the bazaar remains still to be expended. Upwards of three thousand five hundred volumes have been taken out for perusal during the year. The lectures have continued to maintain, if not to enhance their high character. There have been thirteen during the year, all well attended. The conversational lectures have much improved, both in intrinsic interest and popularity. Of these, there have been eleven, all given (with one exception) by members of the Society. The classes have been: a Hullah Singing Class; Drawing Class: Bible Class; and a Writing Class, which have all been fairly successful. The Committee desire to draw attention to the fact that the one and only candidate from this Society, Mr. Callanan, who has presented himself for the examinations recently held by the Society of Arts, in London, has obtained from that body a certificate of proficiency in the subjects which he took up. The Committee hope that next year many may be stimulated to follow his example, and assure all members that no effort of theirs shall be wanting to assist, by classes or any other means, the praise-worthy objects which these examinations are designed to carry out. The following are the arrangements for lectures up to Christmas next:—Oct. 20. Concert, by the Hullah Class, director, Mr. Evans. Oct. 29. Lecture, J. Anderson, Esq., "The Evidence of Design in the Animal Creation," with Microscopic Illustrations. Nov. 3. Conversational Lecture, Mr. Holmes, "The Trees and Shrubs of Great Britain," indigenous and naturalised. Nov. 10. Lecture, Rev. J. W. Watson, M.A., "Labour." Nov. 17. Conversational Lecture, Mr. Pugh, "Money: its History and Philosophy, Uses and Abuses." Nov. 24. Lecture, J. H. Stocqueler, Esq., "India." Dec. 1. Conversational Lecture, T. B. Anderson, Esq., "Materials for the Study of Natural Philosophy." (Continued.) Dec. 8. Lecture, S. D. Bird, Esq., "Dreams and Sleep-walking." Dec. 15. Conversational Lecture, Mr. Darnill, "An Evening with Wilkie," illustrated with several engravings from his pictures. The Hullah class commenced a fresh course of lessons on Nov. 2nd. A drawing class, under the superintendence of a master from the Department of Science and Art, at Marlborough-house, will be established as soon as a sufficient number of names are received to warrant the undertaking. Twenty pounds' worth of new standard works have lately been added to the library.

MEETINGS FOR THE ENSUING WEEK.

MON. Geographical, 8½. I. Progress of the British North American Exploring Expedition under Mr. Palliser, F.R.G.S. II. Reports from the Expedition to East Africa under Capts. R. Burton and J. H. Speke, F.R.G.S.

TUES. Civil Engineers, 8. Discussion on Mr. Molesworth's Paper "On the Conversion of Wood by Machinery."
Med. and Chirurg., 8½.
Zoological, 9.

WED. Society of Arts, 8. Dr. Forbes Watson, "On the Composition and Relative Value of the Food Grains of India."

THURS. Antiquaries, 8.
Royal, 8½.

SAT. Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November* 13.]

Dated 2nd September, 1857.

2300. Thomas Hardcastle, Bradshaw, near Bolton-le-Moors—Improvements in machinery for washing textile fabrics and fibrous substances.

Dated 15th September, 1857.

2392. Thomas Archer, jun., Dunston, Gateshead—Improvements in machinery for cutting off and heading lengths of metal, applicable to the manufacture of rivets and other articles.

Dated 21st September, 1857.

2448. Elizabeth Burton West, Kent-terrace, Regent's-park—Improvements in the manner of preparing and applying materials used in brewing to that purpose, and in the various processes and apparatus used in connection with the same, and for a novel apparatus connected with the same. (A communication.)

Dated 6th October, 1857.

2555. Edward Cavendy, New York—An instrument for taking zenith observations at sea (when the horizon is obscured) of any planet.

Dated 10th October, 1857.

2598. George Frederic Lombard, Paris—Improvements in steam-engines.

Dated 19th October, 1857.

2664. Luigi de Cristoforis, 67, Lower Thames-street—An improvement on the system of vehicle wheels, to be called the "De Cristoforis Conical Wheels."

2670. Benedict Barnard and Alfred Rosenthall, Cheapside—A new ornamental fringe or fringed fabric, also the means of producing the same.

2672. Henry Wimball, Aldermaston, Berkshire—Improvements in machinery or apparatus for the manufacture of bricks, tiles, pipes, and other articles of a similar nature.

2674. William Edward Newton, 66, Chancery-lane—Improvements in the manufacture of drawing rollers. (A communication.)

Dated 20th October, 1857.

2678. Marc Antoine François Mennons, 29, Rue de l'Abbaye-Montmartre, Departement de la Seine, France—An improved hydraulic press.

2680. Robert Atkinson and Thomas Brearey, Baildon, near Bradford, Yorkshire—Improvements in loom pickers.
2682. Frances Windhausen, Duderstadt, Hanover—Improvements in increasing the adhesion of the wheels of locomotive engines to rails when moist.

Dated 21st October, 1857.

2688. Alfred Vincent Newton, 66, Chancery-lane—Improvements in the construction of sewing machines, and in the mode of operating such machinery. (A communication.)

Dated 22nd October, 1857.

2690. Charles Reeves, Birmingham—Improvements in repeating or revolving fire arms.
2692. James Hinks, Birmingham—An improvement or improvements in stiffeners for wearing apparel.
2696. John Milne, Royton, Lancashire—Certain improvements in carding engines.
2698. David Hogg Saunders, Craig Mill Cottage, Rattray, Perth—Improvements in the preparation and manufacture of textile fabrics and materials.

Dated 23rd October, 1857.

2700. Thomas Rand and George Beckley, Oxford-street—An improvement in saddle-trees.
2702. Alexander Theophilus Blakely, Tunbridge Wells—Improvements in laying submarine telegraphic cables.

Dated 24th October, 1857.

2706. Alfred Vincent Newton, 66, Chancery-lane—An improvement in the process of making wrought-iron beams or girders. (A communication.)

Dated 26th October, 1857.

2711. James Fairclough, John Fairclough, and Joseph Cowan, Liverpool—Improvements for suspending and working window hangings and other drapery curtains.
2713. Charles de Clippèle, Brussels—Improvements in the manufacture of boots and shoes, harness, and driving straps, which improvements are applicable to uniting various materials together, and also for waterproofing.
2715. Rev. John Walter Lee, Chelmsford—Improvements in communicating between the different parts of railway trains.
2717. Aaron Marks, 119, London-wall—An improved fastening for gloves and other articles.

Dated 27th October, 1857.

2719. Charles Cadby, Liquorpond-street—Improvements in pianofortes.
2721. James Newall, Bury—Improvements in railway breaks and signals, and in the machinery or apparatus for working the same.
2723. Marc Antoine François Mennons, 39, Rue de l'Echiquier, Paris—An improved varnish. (A communication.)

Dated 28th October, 1857.

2725. William Irlam, Gibraltar Works, Newton Heath, near Manchester—Improvements in wrought iron railway chairs, sleepers, and crossings.
2727. John Addison, Tours, France—Discovering and destroying hydrogen or carburetted hydrogen gas and other gases in coal mines, dwelling houses, and other places.
2729. William Smith, 10, Salisbury-street, Adelphi—Improvements in couplings or connections for shafts. (A communication.)
2731. Abel West, Wormley Ring, Hoddesdon, Hertfordshire—Improvements in the manufacture of candles.
2733. George Shillibeer, 1, Commercial-place, City-road, and George Giles, 10, Gray's-inn-square—Improvements in omnibuses.
2735. William Clark, 53, Chancery-lane—An improvement in rails for railways. (A communication.)
2737. William Clark, 53, Chancery-lane—Certain improvements in machinery for carding cotton, wool, and other fibrous substances. (A communication.)
2739. Elizabeth McDowall, Johnstone, Renfrew, N.B.—Improvements in steam hammers. (A communication.)
2741. Henry Taylor, Staley-bridge, Lancashire—An improvement in the "cans" employed in connection with machinery for preparing cotton and other fibrous materials for spinning.
2743. Robert Alexander Ronald, Paisley—Improvements in the manufacture of shawls.

Dated 29th October, 1857.

2745. William Delf, jun., Great Bentley, Essex—Improvements in ploughs.
2747. Pietro Feloj, 97, Holborn-hill—The improvement of an illuminating reflector of light from gas, oil, or candle.
2749. David Allison and John Livingston, Manchester—Improvements in machinery or apparatus used for regulating the weight or pressure to top rollers used in spinning or preparing fibrous materials to be spun.
2751. Jonas Craven, Bradford, Yorkshire—Improvements in machinery or apparatus used in weaving.
2753. George William Robinson, Barton-on-Humber—Improvements in clod-crushing rollers.

Dated 30th October, 1857.

2755. Joseph Boyes Fraser, Kenilworth—An improvement or improvements in lubricating shafts, axles, screws, and other articles requiring lubrication.
2757. William Clark, 53, Chancery-lane—Improvements in tackle blocks. (A communication.)
2759. William Harwood, Mendlesham, Suffolk—Improvements in reaping machines.
2761. John Lawson, Leeds—Improvements in machinery for roving flax and other fibrous substance. (Partly a communication.)
2763. Samuel Knowles, Tottington Mill, near Bury—Improvements in "dunging" fabrics preparatory to dyeing.

Dated 31st October, 1857.

2765. George Bell Galloway, 42, Basinghall-street—Improvements in the construction of merchant ships and other vessels, in motive powers, propulsion and boiler furnaces.
2767. James Owen, Worsley, Lancashire—Improvements in machinery or apparatus for the prevention of accidents, applicable to hoisting and other lifting machines.
2769. Richard Martin, Ebenezer Hall, and Joshua Hall, Shrewsbury Works, Sheffield—Improvements in steam hammers.
2771. Richard Archibald Brooman, 166, Fleet-street—Improvements in the construction of boats. (A communication.)
2772. Johann Julius Schuessel, Breslau, Prussia, and Peter Julius Thouret, Berlin—The manufacture of a composition which will render inflammable materials incombustible.
2773. William Woodhead, James Woodhead, and John Woodhead, Eccleshill, near Leeds—Improvements in the manufacture of kiln tiles, and in the machinery or apparatus employed therein.
2775. Prodromos B. Kyishogloo, Constantinople—Improvements in obtaining and applying motive power.
2777. George Hallen Cottam and Henry Richard Cottam, St. Pancras Iron Works, Old St. Pancras-road—Improvements in stable fittings.

Dated 2nd November, 1857.

2779. Robert Kirkman, St. Helen's, Lancashire—Improvements in the fusees of lever and other watches.
2781. Eugene Murray, Beresford-street, Woolwich—Preventing accidents on railways.
2783. Charles Iles, Birmingham—Improvements in wardrobes or similar receptacles for articles of dress, and in stands, frames, and pins for holding or suspending articles of dress.
2785. James Apperly and William Clissold, Dudbridge, Gloucestershire—Improvements applicable to carding and condensing engines.

Dated 3rd November, 1857.

2789. James Edward Boyd, Hither-green, Lewisham—Improvements in skates.
2791. David Harcourt, Lozells, Birmingham—Improvements in wrenches.
2793. Rudolph Wappenstein, Manchester—Improvements in doctors or scrapers used for cleaning engraved surfaces.
2795. William Edward Newton, 66, Chancery-lane—Improved machinery for cutting files. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

November 13th.

1359. William Sissons and Peter White.
1367. Daniel Reading.
1369. Charles Bartholomew and John Heptinstall.
1370. Joseph Aizlewood
1378. Edward Gripper.
1383. Francis Parker.
1386. Henry Jones.
1398. James Apperly and William Clissold.
1403. Charles Reeves.
1495. Edward Welch.
1513. Thomas Hart.
1517. Thos. Willis and G. Chell.
1541. John Aiken Salmon.
1607. John Robertson.
1697. Henry Brinsmead.
2329. Peter Armand le Comte de Fontainemoreau.
2349. Leon Louis Honoré Bertou.

November 17th.

1394. Rudolph Bodmer.
1400. Charles Fréderic Vasserot.
1405. Julius Friedrich Philipp Ludwig Von Sparre.
1412. Charles Weightman Harrison.
1419. George Sharp and William Elder.
1421. Elijah Aldis.
1422. John Harrisson.
1450. Samuel Fox.
1490. William Holland.
1506. Thomas Grahame.
1507. Thomas Taylorson Jopling.
1508. Edward Paige Griffiths.
1520. James Merrylees.
1798. William Crook, Gilbert Rushton, & Joseph Crowther.
1961. Thomas Mosdell Smith.
2018. Henry Doulton.
2053. William Hirst.
2136. George Collier, William Noble, & Ward Holroyd.
2391. Gerd Jacob Bensen.

Patents on which the Stamp Duty of £50 has been Paid.

November 10th.

2399. Peter Armand le Comte de Fontainemoreau.
2502. John Clarke.

November 11th.

2429. Samuel Henton.

November 12th.

2408. Lancelot Kirkup.
2423. James Buchanan.

November 13th.

2402. Joseph Armstrong.
2426. Robert Wilson.

November 14th.

2425. Peter Knowles and Edward Kirby.
2432. William Hann.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4033	Nov. 16.	The Fuel Economiser or Cinder Save-all	John Henry Hodd	29, Hill-street, Peckham, Surrey.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 27, 1857.

NOTICE TO MEMBERS.

The Council hereby convene a Special General Meeting of the Members of this Society, to be held on Tuesday, the 1st of December, at 7 o'clock, p.m., for the following purposes:—

1. To revoke the five existing Bye-laws which relate to the Board of Examiners, and to make and adopt other Bye-laws in the place thereof.

2. To consider the amended and extended scheme of Examinations which the Council propose to carry out in concert with the Institutions in union.

3. In compliance with a requisition received from certain members, "to take into consideration and decide on the propriety of continuing to hold Local Examinations of the Members of Mechanics' Institutions and similar societies, and to award certificates of merit accordingly."

4. And, generally, to pass such resolutions as may express the sense of the meeting in relation to all or any of the before-mentioned subjects.

By order of the Council,

P. LE NEVE FOSTER, Secretary.

Society's House, Adelphi, London, Nov. 23, 1857.

EXAMINATIONS FOR 1858.*

NOTICE TO THE INSTITUTES.

1. In 1856 the Society's Examinations were held in London alone. In 1857 they were held in London and Huddersfield.

2. In 1858, and thenceforward, it is proposed to hold them simultaneously at all places, throughout the whole extent of the Union, where suitable arrangements can be made by the authorities of the Institutes.

3. The Society of Arts cannot satisfactorily hold oral examinations, simultaneously, in many places. The Society's Examinations, therefore, will in future be wholly by papers.

4. The Council invite the Institutions in union to assume in future a larger share of authority and responsibility in the management of the Examinations.

5. Bearing in mind that the Union of Institutions was formed for the purpose, not of superseding, but of promoting and supplementing, the action and self-government of those bodies, the Council propose the following scheme of

Previous } Examinations by the { Local Authorities.
Final } Examinations by the { Society of Arts.

* The Programme with the subjects of Examination may now be had of Messrs. Bell and Dalby, 186, Fleet-street, publishers to the Society of Arts.

Previous Examination by Local Boards.

6. The Institutes in different parts of the Union are invited to appoint Local Boards, who will conduct the previous Examinations of their own Candidates, and also supervise the working of the papers which the Society's Board will set for the Society's Final Examinations.

7. No Candidate can be admitted to the Final Examinations without a Certificate from his Local Board, that he has satisfactorily "passed" its previous Examination (*a*) in the elementary subjects specified in par. 10, 11, 12, 13, and (*b*) in the special subjects in which he wishes to be examined by the Society's Board.

8. The previous Examinations must be held twelve weeks before Whitsuntide.

9. Unreserved communications between the Society and the Local Boards will be requisite to secure to the "passes" of the various Local Boards throughout the Union such an uniformity of value as may be attainable; and it is hoped that their standard may be raised, carefully and gradually, from year to year, in order that the scope and authority of those bodies may be constantly on the increase.

10. The previous Examinations of the Local Boards will test the handwriting and spelling of the Candidates, their knowledge of English grammar, composition, and the common rules of arithmetic, as well as their knowledge of those special subjects in which they seek to be examined by the Society's Board of Examiners.

11. Handwriting.—A bold even round-hand, without loops, longtails, or flourishes, should be preferred.

12. English Grammar and Composition.—An extract from some standard English author may be set, into which errors of spelling, grammar, and punctuation are introduced. Some faulty grammatical constructions in common use, and vulgarisms, may be submitted for correction.

13. Arithmetic.—A knowledge of the elementary Rules, including the Rule of Three, should be required.

Final Examination by the Society's Board of Examiners.

14. The names of the "passed" candidates, and the subjects in which the Society is to examine them, must be made known to the Council eight weeks before Whitsuntide.*

15. The Society's Examiners will then set the papers for the final Examination; and these will be forwarded to Local Boards. The Local Boards will see, and certify to the Council, that the papers are fairly worked, by each Candidate, without copying from any other, and without

* The required number of forms for this purpose will be forwarded to the Local Board on application to the Secretary of the Society of Arts.

books or other assistance; and will return the worked papers to the Council.

16. No person who shall not have been, for six months previously, a member of an Institution in union with this Society; no person under sixteen years of age; no graduate or undergraduate of any university of the United Kingdom; no student of any of the learned professions; no certificated schoolmaster or pupil-teacher; and no person who has not satisfactorily "passed" the previous Examination of the Local Board, is eligible for examination by the Society's Examiners.

17. No Candidate will be examined in more than three subjects.

18. The Examinations will be conducted by printed papers. Every paper will, in general, be divided into two sections; an easier, and a more difficult one. Satisfactory answering in the former will entitle a Candidate to a Certificate of Competency. The Examiners will award Certificates of three grades, but Certificates of the first grade will be awarded only to a high degree of excellence.

19. The Final Examinations of the Society of Arts will be held on Whit Monday, the 24th of May, 1858, and on such successive days as may be requisite, simultaneously at such places, throughout the Union, as can make satisfactory arrangements for the previous Examinations of the Local Boards, and for the supervision of the working of the papers in the final Examinations of the Society's Board.

20. Judgment will then be passed by the Society's Board of Examiners, and the Awards, Prizes, and Certificates will be communicated to the parties concerned.

21. The Prizes and first-class Certificates will be awarded at some local centre of importance. The Council will afford some aid to the travelling expenses of the candidates who may desire to come up and receive their Certificates.

Associates in Arts of Oxford and Cambridge.

22. The Council have read with the greatest satisfaction the Statute, recently published by the University of Oxford, for examining and granting the title of "*Associate in Arts of Oxford*" to young persons not of the University. Cambridge is happily following this excellent example.

The Examinations are to be annual, independent of any denominational test, and open to all youths under 18 years of age.

With the view of assisting to bring the proposed titles of "Associate in Arts of Oxford," and "Associate in Arts of Cambridge," within the reach of the members of Institutes in union with this Society, the Council will grant to each youth, not less than 16 or more than 18 years of age, who shall obtain, in 1858, three of the Society's Certificates of the first class in the subjects contained in the Oxford and Cambridge programmes, the sum of £5 towards his expenses, if he attends at the University and undergoes the Examination there.

By order of the Council of the Society of Arts.

P. LE NEVE FOSTER, *Secretary.*

Nov. 23, 1857.

SECOND ORDINARY MEETING.

Wednesday, Nov. 25, 1857.

The Second Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 25th inst., Dr. Lyon Playfair, C.B., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Burley, Benjamin	White, William Foster,
Haywood, Fred. Michael	F.R.G.S., F.G.S., &c.

The Paper read was:—

ON THE COMPOSITION AND RELATIVE VALUE OF THE FOOD GRAINS OF INDIA.

By J. Forbes Watson, A.M., M.D., Bombay Army.

Before proceeding to consider the composition and relative value of the more important of the food grains of India, a few preliminary remarks will be necessary; and, first, I have to state that the researches on which the following observations are chiefly founded, have been conducted under orders received from the Court of Directors of the East India Company, with the object of illustrating the nutritive value of the principal division of the food resources of our Indian Empire.

The details, chiefly chemical, connected with this investigation will be fully discussed elsewhere, and, therefore, in the meantime, I confine myself to those points which, from their dietetic and commercial relations, seem of chief interest.

Viewed with reference to sound social and political conditions, the quality and amount of the vegetable food substances which a given country furnishes, or can furnish, is pre-eminently of vital importance, and to no country more so than to India, in which the vast bulk of the means of subsistence of 176,000,000 of inhabitants is directly gathered from the soil. Every country has its vegetable products, differing much in value and nutritive quality; and to improve the state of agriculture, to increase the productive powers of the soil, and to bring the food grains of the rich within reach of the poor man's purse, is, in other terms, to increase human happiness, to advance civilization, and to plant deep the roots of a sound national wealth. As Dr. Royle has forcibly pointed out, the slightest enlargement in the size of a grain, or the least increase in the productiveness of an ear of corn, when extended into the agriculture of a country, will infinitely increase its resources and revenues. The advancement of agriculture is, for every reason, then, the interest of the state, and in addition to the welfare of its people, and the condition of its finances, the question has other deep connections. England has had her bread riots, and France is not the only empire in the world's history whose political existence of the hour has hung upon her heads of corn.

So far, then, with reference to the importance of agriculture to the state, and to the direct relations of the cultivator to the soil.

Experience has, to a certain extent, taught man the relative nutritive power of the food products around him. Market value, indeed, usually stamps this. Still the researches into this subject during the last 10 or 15 years, which have shed a broad light on many points formerly obscure, can be brought to bear in the most important way on many questions which affect the interests of the people and of Government. The productions of India are as numerous as its surface is diversified and its climate various, and a glance at these tables will show that its food grains in point of number alone occupy no unimportant position. These, with a few exceptions, are cultivated (in, however, very varied quantities) throughout the whole of India, and form the staple food of the mass of the population. In the plains of Upper India, to the west, in Guzerat and Scinde, wheat is extensively cultivated, and in the north, along with barley, constitutes the common food of the people, whereas in the south, wheat for the most part is a luxury which the poor man cannot reach. Thus, also, rice at the deltas, and by the sides of large rivers, is the chief food of the million, but pass inland some distance, and it in its turn has become available only to the rich.

Here the poor man sighs for the "Chowl" (rice) of the river level, and looks with less favour on his staple millet, which experience in some places has, however, shown, and science in these tables demonstrates, to be in some respects superior to rice; and thus in given cases chemistry may confirm experience, and settle certain conclusions on a firmer basis.

A mixed diet has been declared essential for man, and this, the grain-fed inhabitant of the East, carries into practice in a sense as strict as when we add flesh to bread and vegetables. The food grains of India present the usual grand divisions into cereals and pulses, and under these heads are arranged the various classes of grains used as food for man and beast. First, then, on the list of cereals stands wheat, which, *par excellence*, may be considered the grain in which almost the requisite balance exists between the nitrogenous or flesh-forming constituents, and the non-nitrogenous or heat-yielding and fat-forming elements, and, indeed, wheat-flour may be taken as the standard by which to compare the relations between the nutritive components of other grains. Bread will, under ordinary conditions, support the system for a longer period than any other compound, and it is possible that, were man less a "cooking animal," it would do so under conditions demanding more than ordinary muscular exercise. Bread and water does, however, present but little variety to the palate, and it is well known that with, as far as we at present know, the plastic and carbonaceous elements in proper proportion, the human system demands change, and that *sameness* alone will in time produce that somewhat enigmatical disease, scurvy. The relations between the nitrogenous and non-nitrogenous constituents of our Indian and English wheats, as seen in the Table No. 3, is as 8·6 of the latter to one of the former, and, allowing a proportion for the extra quantity of nitrogen which the bran of the whole meal contains, about 6·6 may be taken as the relation which exists between these important constituents in wheat flour; that is to say, that a compound consisting of from six to six and a-half pounds of non-nitrogenous to one of nitrogenous matter, contains these in the proportions required by the human body under ordinary conditions. Suppose, then, that six non-nitrogenous to one nitrogenous represent the proportions in which the system demands these elements to exist, and we have at once a standard by which to measure the nutritive value of other grains, and a reference to the table will show that almost all the others on the list either fall considerably short of, or go beyond, the point thus fixed. Take rice, for instance, and let us illustrate this as well as some other points of interest. In rice it will be observed that the proportion of carbonaceous matter, such as fat and starch, to albuminous compound, is, in some cases, twice as much as it is in wheat, and that on the average it amounts to ten and a-half of the former to one of the latter, instead of six, which we have assumed to be about the proper amount. The native of India would consequently have to eat twice as much of rice as he would of flour in order to obtain the requisite amount of nourishment, and to supply the never-ceasing wear that is constantly going on in the human body.

The popular notion is that rice forms the entire bulk of the diet of almost all the inhabitants of the East, and those, even on the spot, who, with vision unopposed by superfluous clothing, have seen a thin lanky Cooly sit down to his evening meal, and have watched the gradual development that has attended his operations, might feel disposed to coincide in this, but, nevertheless, it is not a fact that the native of India lives on rice. Rice, when he can afford it, certainly does form the bulk of his food, but, as a rule, viewing the population as a whole, it is the food of the rich. The stomach of the poor ryot, large as it is, could not with impunity take in and digest the quantity of rice which would be required to supply the sanguigenous or blood-forming wants of his system, and accordingly nature's promptings have led him to add one or other of the numerous pulses shown in Table 2, in quantity sufficient to supply to the starchy rice the requisite amount of nitrogen, containing, as many of them do, nearly twice as much of that essential element as wheat.

There are, of course, other articles of diet, non-vegetal, which, according to caste, that incubus of India, various classes are permitted to employ, such as eggs, fish, and flesh of certain animals, &c., which must be considered in order to afford a comprehensive view of dietetics in India; but for the present I must confine my observations strictly to the relative nutritive value of these grains, two or more of which conjoined constitute the entire bulk of the solid food eaten by the Brahminical or strict vegetable-eating class.

We see, then, from the fact just mentioned, that experience has taught the native of India to combine these grains, so as to secure a true mixed food in the nutritive sense of the word. As a rule, to his rice he adds from one-fourth to a fifth of some leguminous seed, his favourite one being the *Cajanus indicus*, of which some analyses stand out in Table 2.

These pulses accordingly occupy a most important position in the food catalogue of the country; they are, in fact, to the Brahmin what beef and other fleshes are to us, and their importance now and then receives a sad illustration when their failure as a crop obliges the ryot to have recourse entirely to rice or some of the less nutritious millets.

On the existence, then, of these pulses, or on a supply of animal food, depends, with few exceptions—of which wheat, barley, and oats constitute the chief and almost only ones—the relation which ought to exist between the blood and flesh-forming and heat or fat-yielding elements in a given diet.

A detailed statement of the special results which these tables indicate will be presently given, but before proceeding to do so, a few other remarks on nutritive value will not be out of place, and in making these I may, perhaps, be excused if I repeat one or two things already cursorily touched upon.

At the head, then, of the list of cereals stands wheat, which, as already mentioned, is held, in itself, to contain, in proper proportion, all the elements necessary for the support of animal life, which in the form of bread or cooked flour, at the same time, probably, also affords the bulk which is requisite to the constitution of a suitable diet, and, for this reason, it can be taken for a longer period than fat flesh, which, in a concentrated form, also contains the essential elements in proper proportion.

Experiments, then, with bread have shown that, under ordinary conditions, it will support the system for a period so long that it may be fairly argued that, when it

FOOD GRAINS OF INDIA.

Table I.—CEREALS.

COMPOSITION PER 100 lbs. IN NATURAL OR FRESH STATE.

	DESCRIPTION.			COMPOSITION.									REMARKS.
	NAMES.			ORGANIC.						MINERAL.			
	Common.	Botanical.	Date and Place of Growth, or Market whence obtained.	Moisture.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starchy Matter.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 Nitrogenous.	Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	
			WHEAT.										
1	Wheat, Gehoow Kunak...	Triticum vulgare, &c.	Broach Zilla, 1854	12·40	15·62	1·16	68·74	69·90	4·47	·365	·058	1·98	Employed almost solely as food for man, and as a rule eaten by only the richer classes.
2	,, ...	,, ,,	Bombay Bazaar, 1856...	12·80	13·16	1·05	71·73	72·78	5·53	·371	·067	1·26	
3	,, ...	,, ,,	Guzerat, 1857	13·81	13·05	1·36	70·14	71·50	5·47	·373	·064	1·64	
4	,, ...	,, ,,	Bombay, 1857	13·41	12·84	1·17	70·99	72·16	5·52	·337	·057	1·59	
5	,, ...	,, ,,	Guzerat, 1855-6	10·90	13·23	1·29	73·28	74·57	5·63	—	—	1·30	
6	,, Red variety	,, ,,	Bombay Bazaar, 1857...	13·32	14·80	1·14	68·64	69·78	4·71	—	—	2·10	
7	,, ...	,, ,,	Madras, 1856..............	10·80	12·72	1·03	73·77	74·80	5·79	—	—	1·68	
8	,, ...	,, ,,	Calcutta, 1856	11·78	11·34	1·01	73·97	74·98	6·67	—	—	1·90	
			Mean........................	12·40	13·34	1·15	71·41	72·56	5·60	·362	·062	1·68	
			BARLEY (without Husk).										
9	Barley, Gow.................	Hordeum hexastichon	Bombay Bazaar, 1857...	12·56	14·19	2·58	68·81	71·39	5·03	—	—	1·86	Eaten by man.
10	,, ,, ...	,, ,,	Nepaul, 1850...............	12·90	11·56	1·24	72·30	73·54	6·36	·441	·059	2·00	
			Mean	12·73	12·88	1·91	70 56	72·47	5·20	·441	·059	1·93	
			BARLEY (with Husk).										
11	,, ,, ...	,, ,,	Bombay Bazaar, 1856	—	—	—	—	—	—	—	—	—	For Beasts.
			OATS.										
12	Oats, mixed sample......	Avena sativa	Jata and Moonghyr...	13 52	10·20	3·62	68·72	72·34	7·09	—	—	3·94	Introduced for horses
			MAIZE OR INDIAN CORN.										
13	Maize, Mukka	Zea mays	Bombay Bazaar, 1856...	13·54	9·89	1·63	73·07	74·70	7·55	—	—	1·87	Eaten chiefly by man.
14	,, ,, ...	,, ,, ...	Do. do. 1857...	12·26	8·32	1·65	76·40	77·95	9·37	—	—	1·47	
			Mean........................	12·90	9·10	1·59	74·74	76·33	8·46			1.67	
			MILLETS (Husk Removed).										
15	Millet, Tipsee Gooruroo		Bengal	11·78	8·60	4·16	74·18	78·34	9·11			1·28	In state used by man.
16													
17													
			Mean........................										
			DITTO (with Husk).										
18	Bajra	Penicillaria spicata...	Bombay, 1856	9·82	10·73	3·03	74·46	77·49	7·22	—	—	1·96	Ground whole for [brea
19	,, ...	,,	Bellary, Madras	12·40	10·08	2·20	73·42	75·62	7·50	·367	·042	1·90	,, ,,
20	Great Millet, Joar Jowaree..........................	Sorghum vulgare	Bombay Bazaar, 1856...	12·00	9·64	2·15	74·58	76·73	7·96	—	·040	1·63	,, ,,
21	Great Millet, white variety	,,	Patna, Bengal	12·70	9·20	1·91	74·49	76·40	8·30	·393	·045	1·70	,, ,,
22	Wuree—Khang	Panicum miliare	Bellary, Madras	11·80	10·41	2·02	71·77	73 79	7·09	·328	·056	4·00	
23	Bajra	Penicillaria spicata ..	Narespore, 1856	11·80	10·13	4·62	71·35	75·97	7·48	·260	·042	2·10	,, ,,
24	Tipsee, Gooruroo	Panicum spicata	Bengal	12 80	7·98	4·52	71·90	76·42	9·85	·298	·033	2·80	
25	Natchnee, Naglee	Eleusine coracana ..	Bombay, 1856	11·16	5·68	·52	80·00	80·52	14·17	—	—	2·64	Used mostly in fami [seasor
			Mean..	11·81	9·23	2·62	73·99	76·62	8·70	·329	·043	2·34	
			RICES.										
26	Rice, Chanwul, Bansmutti	Oryza sativa.	Bareilly, Bengal, 1854 .	12·80	8·44	·64	77·62	78·26	9·27	·132	·026	·50	
27	Rice, British-cleaned	,,	Carolina (Lond. 1857) .	12·16	8·07	·64	78 47	79·11	9·80	—	—	·66	
28	,, ,, ...	,,	Java (Lond. 1857)	13·14	7·76	·83	77·92	78·75	10·15	—	—	·35	
29	,, ,, ...	,,	Pegu, 1854	13·50	7·49	·40	78·01	78·41	10·47	·124	·041	·60	
30	,, Pulut	,,	Malacca, 1850	12·90	7·21	·60	78·59	79·19	10·98	·155	·037	·70	Considered a delica
31	,, ,, ...	,,	Broach, Bombay, 1854 .	13·10	7·18	·48	78·64	79·12	11·02	·133	·029	·60	
32	,, Bansmutti	,,	Bombay Bazaar, 1856...	11·60	7·14	·63	79·88	80·51	11·12	—	—	·66	
33	,, Best Puja	,,	Bombay Bazaar, 1856...	12·10	6·96	·60	79·86	80·46	11·56	—	—	·48	
34	,, ,, ...	,,	Patna (Lond. Mar. 1857)	12·80	7·57	·44	78 34	78·78	10·01	—	—	·55	
35	,, ,, ...	,,	Arracan (Lond. 1857) .	13·24	6·48	·56	79·24	79·80	12·31	—	—	·48	
36	,, Red variety............	,,	Bombay Bazaar, 1857 ...	13·00	7·43	·71	77·62	78·33	10·54	—	—	1·24	
			Mean	12·76	7·45	·59	78·56	79·16	10·66	·134	·033	·62	

TABLE I. (CONTINUED.)

STARCHES.

37	Arrowroot....................	Maranta arundinacea	Rutnagerry, Bombay...	15·18	·71	·69	75·90	76·56	107·89	—	—	1·14	
38	Sago	Sagus rumphii	Sumatra, 1850	14·40	·56	·58	84·26	84·84	151·50	·041	·003	·20	
39	Arrowroot....................	Maranta arundinacea	Rutnagerry, Bomb. 1850	17·80	·53	1·22	79·87	81·09	155·00	·161	·007	·58	
40	Curcuma Starch, "Tikor"	Curcuma leucorrhiza	Rohilchund	16·30	·48	·91	80·81	81 72	170·27	·126	·007	1·50	
41	Arrowroot....................	Maranta arundinacea	Cannanore, 1853	16·00	·38	·65	82·51	83·16	218·84	—	—	·46	
			Mean.........................	15·94	0 53	0·81	78·67	81·47	160·68	0·109	0·006	0·78	

MISCELLANEOUS PRODUCTS.

42	Plantain Meal	Musa paradisiaca	Madras	13·10	4·27	1·17	78·26	79·43	18·00	0·159	0·010	3·20	Fruit dried and [ground.
43	Sago meal from pith of sago palm	Phœnix farinifera ...		—	—	—	—	—	—	—	—	—	

TABLE II.—PULSES.

COMPOSITION PER 100 LBS. IN NATURAL OR FRESH STATE.

	DESCRIPTION. NAMES. Common.	DESCRIPTION. NAMES. Botanical.	Date and Place of Growth, or Market whence obtained.	COMPOSITION. ORGANIC. Moisture.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starch, &c.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 Nitrogenous.	MINERAL. Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	REMARKS.
	PEAS, PISUM SATIVUM (WITHOUT HUSK).												
44	Peas, Wattanah, Gol mut-[tur.	Pisum sativum	Benares, 1850	11·28	28·20	1·12	56·82	57·94	2·05	—	—	2·58	
45	Peas, Wattanah	" "	Bombay, 1856-7	12·30	27·72	1·82	55·78	57·60	2·08	—	—	2·38	
			Mean	11·79	27·96	1·47	56·30	57·77	2·07			2·48	
	DITTO (WITH HUSK).												
46	Indian Vetch, Soora Ke[saree	Lathyrus sativus	Calcutta vicinity, 1850..	10·10	31·88	·88	54·64	55·5[illegible]	1·74	·465	·045	3·20	
47	Peas (No. 45, with husk).	Pisum sativum........	Bombay do. 1856-7	12·01	25·01	1·73	58·67	60·40	2·01	—	—	2·56	
48	Do. (No. 44, with husk).	" "	Benares do. 1850..	12·70	25·59	1·21	58·00	59 21	2 31	·323	·058	2·54	
49	Do. white variety	" "	Do. do. do....	12·60	21 97	1·12	62·01	63·13	2·87	·269	·062	2·30	
			Mean	11·86	26·11	1·24	58·33	59·56	2·33	·352	·055	2·64	
	FAVOURITE PEA, CAJANUS INDICUS, (WITHOUT HUSK) (CALLED "DHOLL").												
50	Toor, Urhur, (Toor Dholl)	Cajanus indicus	Jaffrabad, Bombay, 1853	10·08	22·99	1·21	62·66	63·87	2·78	—	—	3·06	
51	" " "	" "	Bombay Bazaar, 1856...	9·80	23·79	1·51	61·60	63·11	2·65	—	—	3·30	
52	" " "	" "	" " ..	9·15	22·30	3·74	61·80	65·54	2·94	—	—	3·01	Rubbed with a little
53	" " "	" "	Palamcottah	11·80	21·75	1·44	61·71	63·15	2 90	—	—	3·30	oil — a common
54	" " "	" "	Broach, 1855...............	12·30	20·09	1·86	75·15	77·01	3·83	·292	·082	2·90	practice.
			Mean..............	10·63	22·18	1·95	68·96	70·91	3·03	·292	·082	3·11	
	DITTO (WITH HUSK).												
55	Toor, Urhur (whole)	Cajanus indicus	Calcutta Bazaar, 1850...	12·80	23·87	1·54	58·39	59·93	2·51	·358	·054	3·40	
56	" (No. 50, with husk on)	" "	Jaffrebad, Bombay, 1853	9·74	20·97	1·04	65·73	66·77	3·13	—	—	3·32	
57	" (No. 43, ")	" "	Palamcottah	11·80	19·37	1·60	63·73	65·3[illegible]	3·38	·425	·056	3·50	
			Mean	12·4	21·4	1·37	62·62	64·0[illegible]	3·01	·392	·055	3·41	
	LENTIL ERVUM LENS (WITHOUT HUSK) ("DHOLL").												
58	Mussoor, ("Dholl" from)	Ervum lens	Bombay Bazaar, 1857...	13·60	25·71	1·29	58·40	59·69	2·32	—	—	1·00	Not eaten by very
59	" "	" "	Calcutta, 1854	11·40	26 03	1·00	59·57	60·57	2·32	·337	·054	2·00	strict Hindoos, on
60	" "	" "	Bombay, 1856	10·96	25·31	1·76	59·77	61·53	2·43	—	—	2·22	account of its red
61	" "	" "	Candeish, Bombay, 1857	10·40	23·49	·99	61·64	62·63	2·66	—	—	2·48	blood-looking colour.
			Mean	11·84	25·15	1·26	59·85	61·11	2·43	·337	·054	1·92	
	DITTO (WITH HUSK).												
62	Mussoor No. 60, with husk	Ervum lens "	Bombay Bazaar, 1856...	10·72	25·04	1·90	60·15	62·05	2·47	—	—	2·19	
63	" (whole)	" "	Calcutta	12·70	24·88	1·02	59·10	60·12	2·41	·332	·046	2·30	
			Mean	11·7	24·96	1·46	59·63	61·09	2·44	·332	·046	2·25	

TABLE II. (Continued.)

"GRAM-DHOLL," CICER ARIETINUM, without Husk.

64	"Chick Pea," Gram chenna	Cicer arietinum	Bombay Bazaar, 1857	13·38	30·07	1·23	53·58	54·81	1·82	—	—	2·34	In this state is largely used as an article of food.
65	,, "Gram" Doll (Gogaree)	,, ,,	,, ,, 1856	9·75	23·16	3·77	60·77	64·54	2·78	—	—	2·55	
66	,, ,, ,,	,, ,,	,, ,, 1856	9·07	22·38	4·52	61·42	65·94	2·94	—	—	2·61	
67	,, ,, ,,	,, ,,	,, ,, 1857	12·06	21·48	4·28	71·82	76·10	3·54	—	—	2·42	
68	,, (Jumboosary)	,, ,,	,, ,, 1856	11·40	20·98	3·78	62·04	65·82	3·13	—	—	2·80	
69	,, ,,	,, ,,	Madras, 1850	11·30	21·04	4·31	60·45	64·76	3·07	·538	·104	2·90	
70	,, New. Ghatie	,, ,,	Bombay, 1857	12·76	19·78	4·47	60·41	64·88	3·28			2·60	
			Mean	11·39	22·70	3·76	63·18	67·09	2·94	·538	·104	2·60	

DITTO (with Husk).

71	Chick No. 68, with husk on	Cicer arietinum	Bombay, 1856	10·80	20·97	3·37	61·96	65·33	3.11	·360	·099	2·90	Chief article of food for horses; quantity, from 5 to 6 lbs. per day.
72	"White Gram," Caboolee, Chuna	,, ,,	Saharumpore, 1854	12·20	20·65	4·63	59·72	64·35	3·11	·406	·042	2·80	
73	Gram Gogaree, No. 65, with husk	,, ,,	Bombay, 1856	9·25	17·98	4·06	66·33	70·39	3·91	—	—	2·38	
74	Gram	,, ,,	Madras, 1850	10·40	21·32	4·46	60·42	64·88	3·04	·461	·107	3·40	
75	,,	,, ,,	Bengal, 1850	11·20	19·51	4·66	61·83	64·49	3 40	·336	·127	2·80	
76	,, Gogaree, No. 67, with husk	,, ,,	Bombay, 1856	12·48	18·08	4·41	61·81	66·22	3·66	—	—	3·22	
77	,,	,, ,,	Benares, 1850	12 00	17·79	5·10	62·31	67·41	3·79	·318	·031	2·86	
78	,, No. 70, with husk on	,, ,,	Bombay, 1857	12·26	17·25	4·46	62·21	66·67	3·62	—	—	3·82	
			Mean	11·32	19·19	4·39	62·07	66·47	3·45	·380	·081	3·01	

BEANS (DOLICHOS SPECIES) (without Husk).

79	Wall	Dolichos spicatus	Bombay, 1857	11·00	23·06	2·09	60·50	62·59	2·71	—	—	3·35	Favourite bean with Hindoos, &c.
80	"Ghot Wall," large variety	,,	,, 1853	12·02	21·04	2·19	60·89	63·08	2·86	—	—	2·86	
81	Chowlee	,, sinensis	,, 1857	13·12	24·44	2·33	56·75	59·08	2·41	—	—	3·36	
			Mean	12·03	23·27	2·20	59·38	61·58	2·66			3·19	

DITTO (with Husk).

82	Guwar	Dolichos fabœformis											
83	Cooltee	,, uniflorus	Bombay, 1856	11·3	24·44	·51	60·40	60·91	2·49	—	—	3·35	Most of these are cooked whole with the husk on.
84	Wall	,, spicatus	,, 1856	10·8	24·57	·79	60·82	63·60	2·96	—	—	3·02	
85	Chowlee	,, sinensis	,, 1856	12·4	24·19	·86	79·41	60·27	2·48	·417	·043	3·14	
86		,,	Bellary, Madras, 1859	11·5	22·54	·77	62·34	63·11	2·80	·262	·050	2·85	
87	Chowlee	,, sinensis	Calcutta, 1854	13·2	22·37	·98	60·45	61·43	2·74	·464	·042	3·00	
88	"Pa da Lout"	,,	Pegu, 1853	13·4	20·54	2·09	60·17	62·26	3·03	·446	—	3·80	
			Mean	12·2	24·06	1·09	61·95	63·17	2·60	·397	·045	3·18	

BEANS (PHASEOLÆ) (without Husk).

89	Ooreed, Moog "doll" Mash	Phaseolus mungo	Bombay, 1857	11·98	25·64	1·61	57·54	59·15	2·30	—	—	3·23	In state used by man.
90	,, ,, ,,	,, ,,	Bellary, Madras, 1850	12·90	23·81	1·11	59·98	61·09	2·56	·461	·054	3·10	
			Mean	12·44	24·73	1·36	58·76	60·12	2·43	·461	·054	3·17	

DITTO (with Husk).

91	Muht	Phaseolus aconitifolius	Calcutta, 1850	12·4	24·52	·61	58·67	59·28	2·41	·368	·051	3·80	The most of these are used for beasts as well as man. They are not so highly esteemed as the others.
92	Ooreed, Mash	,, mungo	Benares, 1850	12·5	24·03	·72	59·65	60·87	2·50	·430	·034	3·10	
93	,,	,, ,,	Bombay, 1857	9·2	24·45	1·44	61·66	63·10	2·58	—	·135	3·26	
94		,, (noleni- very Rox.)	Bengal,	11·8	24·06	·76	59·78	60·54	2·51	·349	·073	3·60	
95	Sona Moog	Phaseolus aurens	Calcutta,	11·4	17·32	2·10	65·48	67·58	3·91	·404	·050	3·70	
96		,,	Madras,	12·1	23·12	·88	60·80	61·68	2·66	·370	—	3·10	
97	Muht	P. aconitifolius	Bombay, 1857		23·31	·67	—	—	—	—	—	3·41	
98			Bombay, 1856	11·0	22·49	·48	63·12	63·60	2·82	—	·055	2·91	
99	Moog	P. mungo	Bellary, Madras, 1850	12·1	21·61	2·06	61·13	63·19	2·83	·476	·060	3·10	
			Mean	12·8	21·65	1·08	61·28	62·48	2·78	·399	0·65	3·44	

MISCELLANEOUS PULSES (without Husk).

100	Bhoot	Soja hispida	Benares, 1850	9·74	46·32	12·41	28·43	40·84	0·88	—	—	3·10
101	Catjang Tahoo		Sumatra, 1850	10·76	41·29	17·64	24·87	42·51	1·03	—	—	5·44
102	Catjang Egow		,, 1850	—	28·85	1·65	—	—	—	—	—	3·87
			Mean	10·25	38·83	10·56	26·65	41·68	0·96			4·14

DITTO (with Husk).

103	Bhoot, No. 100, with husk	Soja hispida	Benares, 1850	10·4	43·86	12·51	28·33	40·84	0·90	·803	·077	4·9	Said to be the source of the "Soy" sauce.
104	Catjang Tahoo	,, ,,	Sumatra, 1850	11·3	39·39	17·75	26·26	44·0	1·11	·607	·121	5·3	
105	Catjang Egow	,, ,,	,, 1850	12·0	27·33	1·15	56·02	57·17	2·09	·485	·021	3·5	
106	Pa Yan	,, ,,	Pegu, 1850	12·6	23·52	·89	59·88	59·88	2·54	·479	·119	4·0	

Note.—The "Nitrogenous Matter" is obtained by multiplying the actual quantity of nitrogen found by 6·3.

FOOD GRAINS OF INDIA.

TABLE III.—(MEAN COMPOSITION PER 100 LBS.)

1. CEREALS.

NAMES.		ON SAMPLE WITH HUSK REMOVED. (Eaten chiefly by Man.)									ON SAMPLE OF WHOLE GRAIN. (Eaten by Animals, and occasionally by Man.)									NOTES AND REMARKS.
		ORGANIC.						MINERAL.			ORGANIC.						MINERAL.			
COMMON.	BOTANICAL.	Water.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starchy Matter.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 of Nitrogenous Matter.	Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	Water.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starchy Matter.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 of Nitrogenous Matter	Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	
Wheat, Indian...	Triticum vulgare	—	—	—	—	—	—	—	—	—	12·40	13·34	1·15	71·41	72·56	5·60	0·362	0·062	1·68	
,, European	,, ,, ...	—	—	—	—	—	—	—	—	—	15·00	12·28	1·50	68·52	70·02	5·70	0·372	—	1·70	
Barley, Indian	Hordeum hexastichon	12·73	12·88	1·91	70·56	72·47	5·20	0·441	0·059	1·93	—	—	—	—	—	—	—	—	—	
,, European	,, ,, ...	—	—	—	—	—	—	—	—	—	14·00	10·08	2·30	69·42	71·72	7·11	0·307	—	2·20	
Oats, Indian	Avena sativa	—	—	—	—	—	—	—	—	—	13·52	10·20	3·62	68·72	72·34	7·09	—	—	3·94	
,, European	,, ,, ...	—	—	—	—	—	—	—	—	—	16·00	13·86	5·00	64·14	69·14	4·98	0·253	—	3·00	
Maize, Indian	Zea mays	—	—	—	—	—	—	—	—	—	12·90	9·10	1·59	74·74	76·33	8·46	—	—	1·67	
,, European & American	,, ,, ...	—	—	—	—	—	—	—	—	—	12·00	11·02	—	69·63	75·63	6·86	—	—	1·35	
Millets, Indian...	(Various species)	11·78	8·60	4·16	74·18	78·34	9·11	—	—	1·28	11·81	9·23	2·62	73·99	76·62	8·70	0·329	0·043	2·34	
Rice, Indian	Oryza sativa	12·67	7·45	0·59	78·56	79·16	10·66	0·134	0·033	0·62	—	—	—	—	—	—	—	—	—	
,, other observers	,, ,, ...	13·00	6·93	0·50	76·87	77·37	11·16	—	—	0·70	—	—	—	—	—	—	—	—	—	
Starches, Indian	(Various)	15·94	0·53	0·81	78·67	81·47	160·68	0·109	0·006	0·78	—	—	—	—	—	—	—	—	—	
Sago-meal, Indian	Phœnix farinifera										—	—	—	—	—	—	—	—	—	
Plantain-meal, Indian	Musa paradisiaca	13·10	4·27	1·17	78·26	79·43	18·00	0·159	0·010	3·20	—	—	—	—	—	—	—	—	—	Fruit dried and ground.

2. PULSES.

COMMON.	BOTANICAL.	Water.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starchy Matter.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 of Nitrogenous Matter.	Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	Water.	Nitrogenous Matter, Gluten, Albumen, &c.	Fatty Matter.	Starchy Matter.	Total Non-nitrogenous Matter.	Proportion of Non-nitrogenous to 1 of Nitrogenous Matter	Phosphorus.	Sulphur.	Total Mineral Matter (Ash).	NOTES AND REMARKS.
Peas, Indian	Pisum sativum	11·49	27·96	1·47	56·30	57·77	2·07	—	—	2·48	11·86	26·11	1·24	58·33	59·56	2·33	0·352	0·055	2·64	
,, ,, ...	Cajanus Indicus	10·63	22·18	1·95	68·96	70·91	3·03	0·292	0·082	3·11	12·43	21·40	1·37	62·62	64·01	3·01	0·392	0·055	3·41	Favorite pea.
,, English		—	—	—	—	—	—	—	—	—	—	23·31	2·00	57·39	59·39	2·54	0·342	0·040	2·30	
Lentils, Indian...	Ervum lens	11·84	25·15	1·26	59·85	61·11	2·43	0·327	0·054	1·92	11·71	24·96	1·46	59·63	61·09	2·44	0·332	0·046	2·25	
,, English		—	—	—	—	—	—	—	—	—	—	26·77	2·25	55·98	58·23	2·14	—	—	3·00	
Grams, Indian...	Cicer arietinum	11·39	22·70	3·76	63·18	67·09	2·94	0·538	0·104	2·60	11·32	19·19	4·39	62·07	66·47	3·45	0·380	0·081	3·01	Chief food for Horses, in
Beans, ,, ...	Dolichos	12·03	23·27	2·20	59·38	61·58	2·66	—	—	3·19	12·2	24·06	1·09	61·95	63·17	2·6	0·397	0·045	3·18	state of "dholl" used
,, ,, ...	Phaseolus	12·44	24·73	1·36	58·76	60·12	2·43	0·461	0·054	3·17	12·8	21·65	1·08	61·28	62·48	2·78	0·399	0·065	3·44	largely by Man.
,, ,, ...	Soja hispida	9·74	46·32	12·41	28·43	40·84	0·88	—	—	3·10	10·40	43·86	12·51	28·33	40·84	0·90	0·803	0·077	4·90	
,, English		—	—	—	—	—	—	—	—	—	—	25·20	2·00	54·00	56·00	2·22	0·395	0·032	2·80	
"Catjang Tahoo"		10·76	41·29	17·64	24·87	42·51	1·03	—	—	5·44	11·30	39·39	17·75	26·23	44·01	1·11	0·607	0·121	5·30	

does cease to do so, it is not because it lacks in well-balanced nutritive power, but because the palate and stomach have become, as it were, wearied; for variety is essential to every dietary that aims at preserving health intact for any length of time.

And, indeed, wheaten bread has been taken by Liebig, the greatest authority of the day, as a proper standard to guide us in the due admixture of the ingredients that, in their sum total, do constitute a suitable diet, and he adds, "that in choosing the various articles of his diet, man is directed by an unerring instinct, which rests on a law of nature, and which prescribes to man, as well as to animals, a proportion between the plastic and non-nitrogenous constituents of his whole diet," and he adds, "it is the elevated mission of science to bring this law home to our minds; it is her duty to show why man and animals require such an admixture in the constituents of their food for the support of the vital functions." One great object in dietetics, then, is to find out the sum that will best express these proportions. "Man's unerring instinct," when left to itself, certainly does lead him, as forcibly illustrated by Dr. Letheby, in his late paper before this Society, to combine, as his means will permit, various articles, so as to ensure a proper balance between essential elements. Still, governments and corporations require the aid of science to decide such points; for one apparently trifling omission in the construction of a dietary, for either soldiers or prisoners, may be the means of depriving the state of most valuable lives, as well as, unwarrantably, of very useless ones. And this, indeed, constitutes an argument for investigations into the food resources of a country, such as that carried out by the East India Company, for such tabular statements place at the disposal of the commissariat officer as well as of the civilian, the means of introducing, with advantage, other than routine articles, should the supply of these be defective.

But to return to the important question, as to what should be considered the proportion that ought to exist between the plastic blood or flesh-forming, and the carbonaceous heat or fat-yielding constituents of a given diet, or, as I shall consider it, grain, for before the comparative nutritive value of the various cereals or pulses shown in these tables can be decided, the standard of measurement must be fixed. The question then is, have we amongst these grains themselves one which will itself furnish this? We have shown the reasons for believing that the flour of wheat contains in proper proportion the elements required to support for a considerable period, the powers of life, and it consequently follows that an investigation into the constitution of wheat is likely to furnish the standard sought for. It will be observed that in wheat the mean of my own experiments places the proportion of non-nitrogenous, or carbonaceous, to one of nitrogenous or plastic, as about five and a-half (5·6) of the former to one of the latter; but as these analyses have been made on the whole grain, the husk or bran of which contains a good deal more nitrogen than the fine flour, six and a-half, although a little under the relative quantity of the above ingredients, shewn by the latest and most trustworthy analyses of bread and fine flour, may be, perhaps, the proper standard. But seeing that experiments with bread fail if much labour be done, suppose that the nitrogenous matter in the fine flour is rather defective in amount, and that the whole meal, which gives rather more than five and a-half (5·6) supplies the proportional factor required; or, seeing that ordinary wheat flour seems to be possessed of almost sufficient power, divide the difference, and adopt 6 parts non-nitrogenous to one nitrogenous, as the statement of the relation that ought to exist between these, and for the present this is what we shall take. And this leads me to make a few remarks on what has been laid down as the true index of nutritive value. It will be observed that what we have been searching for is the number that expresses the proportion that ought to exist between two essential elements in every food, and it is not assumed that nature has insisted on one of these being more important than the other, or that the human system can permit either to be defective. Both the nitrogenous and non-nitrogenous compounds we hold to be of equal moment, for a definite relationship has evidently been established between them; the destruction of which inevitably leads to decay and disease. As far as the welfare of the human body is concerned, there is, perhaps, no element, not adventitious, that can be held to be of more use than another. The importance of plastic material to yield blood and muscle, and of the carbonaceous to supply the heat and fat, stands out in striking relief, but to the vital wants of the system these are not more important than is the fraction of iron in food which enters into the composition of the blood, and to the essentiality of which, if defective in amount, the blanched lip and quivering heart soon testify.

It has been held, that nutritive power is in exact proportion to the amount of plastic or nitrogenous element, and this rule has accordingly been applied to the various alimentary substances used by man.

As already mentioned, whole meal from wheat contains about one per cent. more of nitrogenous matter than fine flour, and, therefore, applying the rule just indicated, it would follow that bread made of the former would be more nutritious than that from the latter, and, indeed, the poor man has been looked upon as somewhat *dogged*, in not having sooner availed himself of the fact which science is assumed to have laid at his feet. But experience has brought even the hard working navvy to a different conclusion. Bulk for bulk, he finds that the fine flour enables him better than the coarse to support the tear and wear of daily toil. Let us admit, however, that this, to a great extent, arises from its physical condition. The labourer finds that the brown bread does not remain long enough to get, as he calls it, the "good of it." The rough brany particles cause a certain amount of irritation, and thus the coarse bread passes too rapidly through the system, and affords too large a residue of that, the removal of which at this moment constitutes a question materially affecting the welfare of the two and a half millions aggregated in this huge metropolis.

The experience of the labourer thus practically nullifies the conclusions of the chemist, as to the nutritive power of the substance we have been considering; but it may be held that if nature had only made bran more soluble and a little less irritating, it would, from its large per centage of nitrogenous element, be an admirable article of food. Condition, whether affecting raw or cooked substances, must ever be kept in view in drawing practical conclusions as to the amount of benefit the human system will derive from given articles of diet, and we shall, therefore, suppose that this has had to do with the failure which attends the use of brown bread by the working man. But we have a very numerous class of substances largely used for food, viz., the pulses, to which, when husked and ground into meal, the objection that holds goods with regard to the "whole meal" of wheat, will not apply.

In our Indian pulses the proportion of non-nitrogenous and nitrogenous compounds, as shown in these tables, varies from a little more than two up to about three of the former to one of the latter, instead of the five and a-half, as in the case of wheat, or six and a-half in that of fine flour or bread; and there is one bean—the *Soja hispida*—in which I have found the proportion between these elements to have the relation of less than one of plastic to the unit of carbonaceous matter; and which, consequently, if the theory is sound which holds that nutritive value is in proportion to the nitrogen contained, would, in power, exceed that of flesh itself.

To the decision of this point experience again comes to our aid, and her conclusions cannot here be rejected for the same reason as in the case of bran, for neither the eye nor the microscope can detect the rough irritating

particles such as are found in bran or brown bread. Take animals, then, and feed them on beans and lentils, which, according to the theory we have been considering, stand amongst vegetable substances at the head of the list, in assumed nutritive power, and what occurs? The health of animals confined to such, for any length of time, deteriorates, and the same takes place in the case of man, even if too large a proportion of peas has entered into his diet. And the results of the (in the very best sense of the word) truly national experiments that year after year are being carried on at Rothamstead, lead to the conclusion that, practically considered, the theory that assigns to different substances a value in proportion to their nitrogenous compounds, is fallacious; and the far greater demand for cereal than leguminous grains to supply the wants of man and animals, certainly shows, from a very broad point of view, the decision to which nature has come on this subject.

Man or other animals when under the influence of hard labour can, however, take in and assimilate a considerably larger quantity of such highly nitrogenised substances; but observation and physiology lead to the conclusion that under such circumstances they require a proportionably larger quantity of carbonaceous matter, and, as Lawes and Gilbert have pointed out, the system of the labourer undergoing more than usual bodily exertion, seems in practice to call for substances containing even more than the ordinary proportion of carbonaceous matter. And even in tropical India, where a disinclination for much fat is likely to exist, it has been found essential to add extra "ghee" or butter to the diet of the prisoners undergoing manual labour. Extra labour does demand an increased supply of nitrogen in the food, but at the same time it probably necessitates a more than proportionately larger quantity of carbon. The soldier who in darkness and silence works, literally, for life in the out-lined trench, wastes fast his straining muscles, and new flesh-particles, or the elements for forming them must be supplied in his food—but it is not the muscle alone that wears out. Muscular exertion involves accelerated respiratory movement and increased cutaneous transpiration, and through the million outlets presented by the lungs and skin, the oxidised carbon streams with rapidity, and probably in amount proportionately in excess of the extra nitrogenous compounds which have resulted from spent muscle-element. Admit, then, that extra labour involves a demand for the plastic and carbonaceous elements of food even in proportions relatively equal, and it logically follows that, adopting the grounds on which the nitrogen theory itself has been formed, the carbonaceous compounds are of as much moment to even the sons of toil as the nitrogenous, or if our suggestion be correct, they hold the more important position of the two.

We find that instinct, through generation upon generation, has led man to form certain dietetic combinations, the component parts of which have a tolerably definite relation to each other, and it is our object to endeavour to ascertain the proportions which nature shows ought to exist between the various elements that in their sum total constitute a proper food for man. That once laid down we have the key to the chief position; but even then an essential element may be wanting, and here it is that the labours of the chemist are brought to bear with advantage. It has been shown that nature has led man to combine the ingredients of his food in unison with the requirements of his system, which, beyond a certain point, seem to vary in accordance with demands made by climate, labour, &c., upon his power. We likewise hold that however these may be increased, the proportionality existing between the demand for essential ingredients in all probability remains much the same, and from this it follows that, having discovered the relation that ought to exist between the essentials in a given food, the next thing is to accumulate information as to the amount of these elements, so as to admit of proper mixtures or combinations being made. This is the information which the chemist can afford, and that which these tables are intended to illustrate. The problem, then, is the relation which exists between the essential constituents of a given grain or mixture of grains—which ensures a diet that will support and give vigour to the human frame. Wheat grain in itself seems to present us with the proper proportions, and from considerations already stated, we, for the present, have assumed six of carbonaceous to one of nitrogenous compound as about what should be taken. In addition to this, we have almost the same conclusion arrived at by another route. Founded upon their own and Dr. Lyon Playfair's elaborate calculations, Lawes and Gilbert, by the examination of eighty-three different dietaries, have inferred that a little above five-and-a-half represents the proportion of non-nitrogenous to one of nitrogenous substance, which may fairly be taken as representing the relation between these important constituents. In these the actual proportional number is 5.52, but as this has been calculated on the assumption that starch chiefly existed in these dietaries, and as these all contained a certain proportion of fat, which, if calculated up to its equivalent of starch as a standard, would give a higher proportion of non-nitrogenous to nitrogenous than that stated, it consequently follows that the number which I have adopted will probably come not far from the wished-for point, and even it may be found to be under rather than above the mark. This, then, will constitute what we conceive to be the test of nutritive value, and I trust I shall be excused the time which I have occupied in discussing this part of the subject; for before entering upon the question of relative nutritive value it was essential to lay down and illustrate the principles which have been applied in working out the number referred to. Given, then, 6 to 1 as the proportion between the carbonaceous and nitrogenous compounds, as indicated by the human system, and it follows that in diet or food articles, any quantity (within the limits of error in the calculation) above or below the point thus fixed, will be, by so much, in the true sense of the word, less nutritious, and from this it logically results that, whereas millets and rice are so, from the excess of carbonaceous, over the standard proportion, pulses are less valuable as sole articles of food, for an exactly opposite reason—the excess of nitrogenous diminishing the required amount of carbonaceous; and, consequently, those pulses will prove of most value that contain the least proportion of nitrogen; and it will be presently shown that the two pulses of the East most in favour and most largely used, are exactly those that come nearest to our standard, in consequence of containing a smaller quantity of nitrogenous compounds than the others. The *Cajanus indicus*, in the husked state called "Doll," is eaten in preference to any other, and a common habit with regard to even it, bears out the argument. It is the almost universal custom to prepare this pulse, for edible use, by rubbing it with a little oil, by which means the proportion of the carbonaceous over the nitrogeneous is increased. No. 52 in the pulse table, represents an analysis of "*Toor doll*" bought in the Bombay bazaar, and which had previously been thus treated, and it will be seen that the average proportion of fat or oil in it has been increased from about 1½lbs. per 100 to 3¾lbs. per ditto, and that the nitrogenous matter has been proportionally diminished by such treatment, and, as before pointed out, if the carbon in this extra quantity were calculated as such, it would give a proportion of that substance 2½ times greater than starch does, and would, by so much, diminish, still further, the proportion of nitrogen to elemental carbon, and bring the substance itself, as an article of diet, still nearer to the standard I have fixed, and, if eaten alone, ensure a proportionately lesser quantity being consumed with impunity, or for a longer time, without detriment to the system: thus affording another example of the manner in which nature

leads man artificially to ensure a proper relation between the constituent elements of his food.

So much for this part of the question. Our standard of comparison now fixed, we are in a position to consider, with advantage, not only these grains, but every diet, however compound. I hope to have the opportunity, on another occasion, of treating at large on the subject of the food of the natives of India, with reference to quality, and, as far as can be ascertained, the quantity also, but for the present I shall confine myself to a statement of the composition of these grains, and of the relation which exists between the amount of principal constituents in these, leaving for another period and place the discussion of the relationship between certain other important elements, which involve details more strictly chemical than those likely to interest the general public.

First, however, before examining these tabular statements which contain in detail the information with regard to these grains, I wish to lay before the public a few remarks on the more prominent points presented by the agriculture of India, which will not here be out of place. The value and pre eminent importance to India of its agricultural products, may be stated in a sentence. According to returns before me, the total value of the agricultural products exported from India in 1853 amounted to £17,484,133, representing more than four-fifths of the then entire value (£21,519,861) of Indian commerce. Of this sum, £889,040 is laid down as that received for the grain products of the soil. Viewing this statement as a whole, it has, with reason, been said that the greatness of India in the world's estimation depends on her agriculture, and that for her future prosperity and progress, reliance can alone be placed on the improved cultivation of her soil, and on the facilities that may be afforded to enable her to bring her products to the best markets, whether in or without the country, at the lowest possible expense.

With regard to the actual cultivation of the soil itself. Considered generally, this is not yet in a satisfactory condition, although considerable efforts on the part of Government have been made to improve it; and Dr. Royle's late work on cotton shows the exertions already devoted to the development of an article of such paramount importance to this country. A good deal of valuable information bearing on cultivation, as practised in the widely separated districts of India, exists, which it would be interesting to give a summary of, but for the present I must content myself with briefly stating that in some points the cultivator in India is not so far behind his European brother as is generally believed. The rotation of crops has been known and practised for ages, and even the rude-looking implements which they employ, viewed with reference to the power at command, the state of the soil, and the means of the ryot, are well adapted to attain the end in view. And in this, as in some other matters, it would be well if attention were directed to the improvement of what has been, and is found, to suit the circumstances presented by an Indian soil and climate, rather than to attempt to supersede these by the introduction of the actual implements employed in this country.

We shall proceed now to the consideration of the composition of the grain products themselves. In the tables placed before the meeting, these will be found to be classified under the usual heads of cereals and pulses, and at the bottom of the cereal table another, denominated "starches," is placed as that substance enters almost entirely into the composition of the articles indicated, and in addition there is at the bottom of both tables a few substances which I have placed there, either from their peculiarity, or from, in one or two instances, the difficulty experienced in classifying them. With regard to the specimens employed for analysis. Upwards of forty of these were furnished me by Dr. Royle, from the new and most important museum of industrial products, rapidly being brought to completion at the India House. These embrace samples of all the important species of grain cultivated in India; but as the date of growth of many of these goes as far back as 1850, as a check I procured fresh samples from Bombay—some overland within the last three months—and these, in number nearly fifty, have also been subjected to analysis. And I may mention that the two larger tables, 1 and 2, are intended to serve as an index catalogue to the composition of the samples in the bottles on the table.

In an undertaking of this sort it was essential to obtain assistants, whose chemical knowledge and practical skill were worthy of the importance and extent of the undertaking, and it is at once a pleasure and a duty to state my obligations to the zeal and ability brought to my aid during the whole of this investigation by Mr. Frederick Manning and Mr. Wentworth Scott, and for shorter periods by Mr. W. Valentine and Mr. Frank Fowler. To Mr. Manning's experience of upwards of eight years in the Rothamstead laboratory, I am indebted for the admirable and extensive series of estimations on which the principal part of the organic division shown in these tables depends; and it is also due to Mr. Scott to mention that the practical details connected with the mineral department have chiefly been carried out by him.

It will be observed that in drawing out these tables, two chief divisions have been adopted, depending on whether the sample of grain was operated upon whole, or with the husk removed, the last giving the state in which, as a rule, the article is employed for human food. The next two principal divisions are into "organic" and "mineral," and the divisions of these, again, are seen in the tables.

The importance of the constituents, stated under the organic division, at once strikes the mind, but, if time permitted, it would not be difficult to still further illustrate what I have already briefly indicated, viz., that, viewed with reference to the essential wants of the system, and to effects produced upon it, the organic is not, in this point of view, of more importance than the mineral. Of the mineral constituents, the phosphorus, sulphur, and iron are the elements that have chiefly received attention. The contents of the central column within the heavy lines, showing the proportion of non-nitrogenous to one of nitrogenous is that which will, however, chiefly for the present occupy our attention, as, if the arguments brought forward in this paper be correct, that it is which affords the indication of true nutritive value.

At the head of the list of cereals stands wheat, the great food-grain of this and other European countries, and one which in Central India, and to the north, as well as almost to the sea-side in Guzerat, occupies a prominent position in the agriculture of the country. Of Indian wheats, as shown in Table I., eight samples from various districts through India have been submitted to analysis, with the general result of showing a composition fully more identical with that of the wheats of Europe than is generally supposed to be the case. For the statements in Table III., which, under these analyses of the several species of Indian grains, shows the average composition of a number of European wheats, &c., I am indebted to Dr. Gilbert, who has calculated these as the mean from a great number of analyses; but as these embrace the results of one large series of analyses, which all late observations show to be too high, it is quite probable that a fresh investigation of these European wheats would show that they contained fully a less proportion of nitrogen than even that shown in the table. It will be observed that every 100 lbs. of these European wheats contain 15 lbs. of water, whereas the Indian ones have only about 12 and a-half pounds. It consequently follows that a given weight of Indian wheat will contain more nutriment than the same quantity of European, because there is more water in the latter than in the former;

although, if we drive off the whole of the moisture from both, and make the quantity, in either case, up to 100 lbs., it will have the effect of showing a slightly larger proportion of nitrogeneous matter in the European, than even that shown in the table. In the average statement, shown in Table III., it will be observed that the proportion of non-nitrogenous to nitrogenous, is within four-tenths of the standard 6 to 1, which nature has apparently settled to be the relation demanded by the requirements of the system. Upon this showing, the *whole* grain of wheat would require to have a proportion of starchy or fatty element added, in order to dilute or bring it down to the true proportion,—a thing, by another mode, accomplished by the sieve separating the more highly nitrogenous bran from the flour.

With regard to practical qualities, arising from the physical condition of the grains themselves, a word may be said, as it bears on the question of the suitability of Indian grain for the markets of England, a point which Dr. Royle has fully discussed. The Indian are, as a rule, what are called "hard wheats," in which the outer portions, consisting of a very dense substance, are difficult to reduce to fine flour—indeed, proving so detrimental to the mill-stones themselves, that our millers reject them for this cause alone. But the whole question of the practicability of the introduction, at a suitable profit, of Indian wheat into our European markets, supposing,—which appears to be the case—that the original cost in India and the expense of freight to this country would permit of this, is, for the present, settled by the weevil, a small insect, specimens of which, I dare say, can be detected amongst these samples, although some have in order to destroy them, been subjected to nearly the heat of boiling water. The destructive powers of these little creatures, from their numbers, are enormous. Many of the cargoes of wheat attempted to be introduced into this country have been thus all but completely spoiled, and our grain merchants are naturally very loth to admit even partially damaged cargoes into their granaries. These insects are not destroyed by any amount of heat which can practically be applied to wheat in the mass. Cold seems the only means by which they can be removed. With regard to the value in our market here of Indian wheat, I have submitted the samples on the table in Mark-lane, and have found that on an average, cargoes of these would fetch from 35s. to 40s. A cargo of No. 97 was brought from Mádras, and cost here 36s. per quarter. It weighs the full weight of 62 lbs. per bushel—is in pretty fair condition, and is now being employed to add "strength," as it is called, to some soft wheat, the two being mixed in certain proportions. So much for wheat. Next on the list stands barley. This is much used in Northern India, and constitutes a chief article of food in many districts. One of the specimens on the table is from Nepaul and very fine. It will be observed that Table III. shows the mean composition to represent the existence of a smaller proportion of carbonaceous matter to nitrogenous than wheat does, and that, as an article of food, according to the mode proposed of indicating nutritive value, it would require to be diluted, as it were, by the addition of a larger proportion of carbonaceous matter than the whole meal of wheat does. Compared with European barley, it will be observed to contain upwards of two per cent. more of nitrogenous matter.

With regard to oats little need be said. A number of years ago, the *Avena sativa*, the common oat of this country, was introduced by some European gentlemen as food for their horses, and around Patna and in Moonghyr it is now cultivated in some quantities, but not being a stock article I have only submitted one sample to analysis. It looks poor and husky, and contains about three-and-a-half per cent. less gluten, &c., than the European oats shown below it in Table III. The proportion of non-nitrogenous to nitrogenous matter in it, viz., 7.09 to 1, shows that, compared with the standard it contains a little too much carbonaceous matter, and would consequently require to have a small quantity of some grain containing a larger proportion of gluten, &c., added, in order to bring it to the point required. Of samples of Indian corn in a state suitable for my operations, I could only procure two. These, on the average, contain 9 per cent. of gluten, being nearly 2 per cent. less than American, but the chief peculiarity is in the small amount of fat found in these specimens; although this constituent must vary considerably in different samples, for Dumas and Payen procured 9 per cent. of a yellow oil from maize, whereas Leibig has stated 4 25 as the amount which he found.

We come now to a class of grains, the millets, which occupy a position second to none in the country, and which form the staple food of a larger number of the population than, perhaps, all the other cereals put together. At the head of the list of these stands the great Indian millet called *Bajra*, and which itself, with the usual adjuncts of a little milk, &c., forms the chief article of diet of a very large number. Compared with rice, it will be observed to be considerably more nutritious, containing about ten and a-half per cent. of gluten, and giving a proportion between the carbonaceous and nitrogenous compounds of from 7 to 7½ of the former to one of the latter, whereas the one of all those rices on the list most rich in gluten contains only about eight and a-half of that substance, and gives the proportion already so often referred to, as a little more than 9 of the non-nitrogenous to the nitrogenous,—thus involving the addition of a larger proportion of some pulse or extra nitrogenous substance to increase the proportion between the flesh-forming and heat and fat yielding constituents. The Millet *jowaree* stands next in order of importance, both on account of its intrinsic value, as well as of the numbers it chiefly supplies with food. A glance at the table will show how it stands with reference to the last mentioned as well as to rice, and will save the tediousness of repeating in almost the same terms facts that can be seen at once. With regard to the millet which very properly stands at the bottom of the list, viz., *Khang* or the *Eleusine coracana*. Its low nutritive power is at once seen, and the necessity for adding pulse, &c., in order to bring its important ingredients into proper proportion. This grain, in some districts, is looked upon entirely as a famine food, and only had recourse to in seasons of drought, when other crops are very defective. In some places, during ordinary seasons, as much as from 130 to 140 lbs. are procurable for a couple of shillings.

We have next to consider rice, which is supposed to feed a larger number of the human race than any other grain, but, as already pointed out, rice is not employed alone to support animal life, and, indeed, the attempt to do so could not be otherwise than attended with failure, unless the stomach of the native had been made about exactly twice as large as it is, and his system endowed with extra capacity for getting rid of a very large quantity of superfluous carbon.

Rice is very largely employed, and certainly is a most important article of diet, but its chief property, in one sense, may be called negative. It plays the part of a diluent to highly nitrogenised compounds, and affords the bulk which seems essential to the formation of a wholesome diet. Rice is, therefore, rarely eaten alone; and when it is so, only from compulsion, as occasionally amongst some of the poorest classes in Arracan and adjoining districts.

Viewed with reference to the wants of the system, it will be observed that the proportion of carbonaceous matter to plastic, which it contains, is nearly twice as great as it ought to be. In order to afford, from my own laboratory, the means of comparing it with others, the vaunted Carolina rice has been subjected to analysis, and the result is that, as may be seen in the table, in point of plastic power it would have stood at the top of the list, but for the Bengal variety of rice, called *Bansmutti*.

Next to the Carolina rice comes a specimen of Java rice, which, in point of nutritive power, is within a fraction of its American brother; and, although its physical properties, also, are such as barely to permit of its being distinguished from the Carolina, its average price in the market here is several shillings per cwt. less than American cleaned Carolina, or nearly one pound less than British cleaned ditto, a little extra manipulation in this country costing some 15d. per cwt, and, even then, only a practical eye can tell the difference.

Of the "starches," embracing arrowroot, sago, &c., little need be said. A glance at the tables shows that, in these articles, nutritive power is at its minimum, as far as the plastic wants of the system are concerned. The plantain meal mentioned contains much more than any of the others in that part of the list, but, even it, in nutritive power, is not far from being one-half less so than rice, containing as much as 18 per cent. of carbonaceous to nitrogeneous matter.

We shall now shortly turn our attention to the pulses. From considerations already adduced, we have held that the nutritive value of these must be calculated not in accordance with largeness in amount of nitrogenous matter, but in proportion to relatively diminished quantity. From this, as already mentioned, it follows that the *Cajanus Indicus*, the favourite pea of the country, and the *Cicer arietinum*, or "gram," the chief food for our horses, and often of man, too, are precisely those in which the proportion of carbonaceous to non-carbonaceous is highest.

According to this showing, the *Cajanus Indicus* stands first, and gram next;—then follow the Dolichos beans, the next in favour, too, as articles of food; then we have various Phaseoli, and the *Ervum lens*, and lastly, common peas, which seem to contain the largest quantity of nitrogen, and which, therefore, demand an extra quantity of carbonaceous matter in order to obtain the standard mixture of six to one.

Experience has thus pointed out the two substances of this class most suitable as articles of diet, and I believe that their introduction into this country will prove of great use. There are many cases in which an easily digested pulse would prove of great service, and it will probably be found that these two ground into flour will in point of efficacy far exceed the Egyptian lentils, for which in various forms the public has to pay so much.

Gram is the great horse-food of the country, and I believe that, used along with a fair proportion of hay, &c., as a diluent, there does not exist in any country an article for such a purpose of equal value. In the form of "doll" it is parched, and on the voyage, or under circumstances which prevent, (according to his view,) legitimate cooking operations being carried out, it forms almost the entire food of the Sepoy.

These pulses, in varying proportions, are cultivated throughout the whole of India, and their importance, as constituting the chief source that furnishes the plastic or muscle element to a very considerable portion of the inhabitants, cannot be overrated.

For the present neither the time of the meeting nor the usual limits of the Society's *Journal* will permit me to enlarge much longer on this division of my subject. There still remain points of special information which I should like to touch upon, and accordingly a short appendix to this paper will appear in a subsequent number of the *Journal*.

Before concluding, there are, however, two vegetable products which these analyses bring out in strong relief, and show to contain a very large amount of important elements. The first of these is the *Soja hispida*, called *Bhoot* by the natives, and which I find to contain the enormous quantity of upwards of 46 lbs. per hundred of nitrogenous matter, nearly 12½ pounds of oil or fat, about 13 ounces of phosphorus, one ounce and a-quarter of sulphur, and equivalent to nearly half an ounce of iron.

With regard to it, I have been able to obtain but little general information. In Simmond's work on the commercial products of the vegetable kingdom, it is referred to as the source of the well-known "Soy sauce," but if it could be grown and procured in quantity, as an addition to other food, it probably, for feeding purposes, would be found to exceed in value that of any vegetable substance now known.

The other product, to which I would briefly refer, is marked as having come from Sumatra. It bears the native name of *Cutjang tahoo*, and is probably a Dolichos bean, like the former.

Of it I have, likewise, been able to obtain only meagre information. In Mr. Simmond's work, a leguminous plant is mentioned, which furnishes, on pressure, a residuum known under the name of *Tanping*, and which, in the form of a dry paste, is brought to Shanghai, in a quantity amounting in value to two and a-half millions sterling. This last fact is stated on the authority of the Rev. Mr. Medhurst, of Shanghai, and Mr. Thoms, British Consul at Ningpo. The bean referred to is stated as being imported into China,—pressed for its oil, which is used both for eating and burning, and the residuum, in form like large cheeses, is said to be distributed about China in every direction, and used as food for pigs and buffaloes, as well as for manure.

Although I am not in a position positively to state that the bean which I produce this evening is identical with that referred to, still its composition leads me to infer, that if not the same article, it is one perhaps equally worthy of the attention of the agriculturists of this country. On analysis, I find that it contains per 100 lbs. weight, 39.39 lbs. of nitrogenous matter; 17 lbs. 12 ozs. of oil or fatty matter; about 9½ ozs. of phosphorus and nearly two of sulphur.

There are many other special points of interest connected with the subject which I have attempted to bring forward this evening. These, however, must remain for another opportunity.

DISCUSSION.

The CHAIRMAN said he was sure the Society of Arts felt much indebted to Dr. Watson for having given them the benefit of his recent labours. Dr. Watson had been engaged by the East India Company in investigating some of the principal varieties of the food grains of India. At a later period of the evening he (the Chairman) would make a few remarks upon the chemical part of the subject, but at present he felt it would be presumptuous in him, in the presence of one who had devoted so much attention to the vegetable produce of India, and who could give so much information on that subject, to venture to lead the discussion in any way; he would, therefore, call upon Dr. Royle to favour the meeting with his remarks upon the paper.

Dr. FORBES ROYLE, F.R.S., said, the subject was of great importance, and of great interest to himself, and was, moreover, one upon which there was but little information which could be depended upon. He congratulated the Society and the public upon this exact determination of a number of facts hitherto unascertained. He entirely agreed with the author of the paper in repudiating the idea which had generally prevailed in this country that the natives of India lived for the most part on rice. It was only in particular places, in some of the deltas, that rice formed the staple article of food, and it was then mixed with ghee or butter. The principal articles of food throughout India, were the cereals and pulses of which mention had been made, and an interesting point with regard to these was that the climate enabled them to obtain two distinct crops in the year; one, the rainy season crop, and the other the cold season crop. There were, therefore, large quantities of nutritive diet, cereals as well as pulses, all over India, although, from a deficiency of rain in some parts, the crops would occasionally

be materially affected. Dr. Watson had called attention to the nutritive nature of the *Cajanus Indicus* and the *Gram*. In the north west provinces of India, sheep were fattened for the table upon the *Gram*, and the meat was of the most nutritious character. With reference to oats, the specimen which had been analysed was an unfavourable one, having been sent to this country in 1851, from Patna, the lowest part of the province where oats were cultivated. In the north-west provinces, where horses were bred, better oats were grown, and formed a nutritious food for those animals. In the hill districts barley of fine quality was grown, and some of the finest kinds of wheat were cultivated in the neighbourhood of the Nerbudda. Professor Solly had made analyses of both the hard and soft wheats of India, and at that time, wheat being dear, the samples sent over were valued at 105s. and 100s. per quarter—5s. per quarter more than the highest price of English wheat. The white wheat was least esteemed by the natives of India, the hard wheat being considered the most nutritious. He did not know whether chemical analyses bore out the native opinion in this respect. He could not but congratulate those connected with the Exhibition of 1851, upon the results accruing from the collection of so many materials of food from all parts of the world, especially from India. Many specimens of the grain analysed by Dr. Watson were collected on that occasion, and were found still to be in an excellent state; and the remarkable pulse, to which he had drawn attention, was one of those upon which it would be desirable to obtain further information, for, he believed, it might become an important article of commerce, when its valuable qualities were better known.

Mr. RIDDELL had resided for a long time in India, and was acquainted with almost every kind of grain produced there. He would corroborate the statement, that rice certainly did not form the chief article of food of the natives, although it was to be found in almost every part of the country, and there were no fewer than between 70 and 80 species of rice shown at the Madras Exhibition. The natives themselves used the commonest descriptions of it for their own eating, the finer qualities being reserved for the rich man's table, and the growers seldom tasted of their own produce. That rice, itself, was not so nutritious as many other grains, could not be doubted; but, when mixed with some of the vegetable products now before them, he believed it formed as nutritive food as wheat itself. Indian wheat ground into flour would not keep good for any length of time, and hence the bread and biscuits made in Calcutta for the navy were manufactured from newly ground wheat; indeed, the European and Cape samples were preferred to those of native growth. He had found that wheaten flour, kept in the best possible way, became mouldy in three or four weeks, and, for that reason, the natives and bakers always used it fresh ground. In the district of the Nerbudda, he had seen wheat growing in such quantities that there was not sufficient population to eat it and it remained on the ground. If means of conveyance to the coast could be obtained, they would have large quantities of wheat for exportation. He would mention, with regard to the gram, that he planted some in June last, soon after his arrival in England, which had produced as fine seed as any he had seen in India. With reference to the Dolichos, his idea had been that it was cultivated in England, and he had heard that in this country they manufactured soy from it. He believed that Indian beans, and many other seeds of great value, might be successfully cultivated in this country. With reference to the larger descriptions of millets he could say nothing, except that they were very prolific, and found to be highly nutritious diet, judging from the healthy appearance of those who used them. Spices and other condiments appeared to increase the nutritive qualities. With reference to Indian corn—the large corn—there were two kinds grown, one of which he had himself seen bearing on one stem seven or eight large heads, some of which produced as many as 500 seeds. The colours of this grain were yellow, red, and white. That it was a highly nutritive food there could be no doubt. Man thrived well upon it, when it was eaten either boiled or roasted; and cattle were fed upon the stems, which contained a large quantity of saccharine matter.

Mr. P. L. SIMMONDS said that his name having been mentioned by Dr. Watson in his paper, he might be permitted to make a few remarks, the more especially as the subject of the paper was one of those which he had suggested to the Secretary some time since, as one on which it was highly desirable to elicit information. He was, therefore, glad it had been so promply responded to, and so ably dealt with. The analytical and chemical portion of the subject being that which had been chiefly discussed so fully, he would confine his observations chiefly to the commercial aspects. The consideration of the food grains and pulses of India, nay, even of the roots, starches, and fruits of the East generally, was of considerable importance, not only to the natives who produced them, but also to many of our colonies, which depended chiefly on them for supplies, and to the inhabitants of Europe. Although it was endeavoured to be shown that rice was not the only food of the natives of India, still it could not be denied that it formed the chief bread-corn of the East, and was the principal grain exported from India. Not only did it form an article of immense consumption in China and most parts of India, but it was shipped in large and yearly increasing quantities to the Straits settlements, our colonies in the Indian Ocean, to Australia, and to Europe. At least 3½ million bushels were annually shipped to Ceylon, to feed the 60,000 or 70,000 Indian immigrants who went there to labour on the coffee plantations; 60,000 or 70,000 bags a month were also required for the Mauritius, besides large quantities of grain for the Coolies employed on the sugar estates. With the extensive Chinese emigration now going on to Singapore, Malacca, Penang and Australia, in each of which there were probably 50,000 or 60,000 Chinese located, and the number yearly increasing by thousands, there was necessarily a large demand for rice for a population otherwise engaged in producing sugar, spices, and other staples, and not producing food-grains. Our own imports of rice were also largely on the increase, for we could depend on receiving but a very small supply of the choice rice from Carolina, which had been alluded to by Dr. Watson. Slave labour was found to be more profitably employed on cotton, and the crops of South Carolina rice were therefore yearly declining. But unlimited supplies could be drawn from the East, whether of the superior Java rice, or of the more ordinary Indian qualities. While in the Irish famine year of 1847, we received but 588,708 cwt. of rice, and in 1853, but 1,504,629 cwt. of cleaned rice, and 19,500 qrs. of paddy, or unhusked rice; last year we imported 3,689,969 cwt. and 33,000 qrs. of paddy; about half of which was entered for home consumption. And this year, notwithstanding the commercial and political disturbances, the amount in the nine months of the year reached about 2,000,000 cwt. Rice, it should be remembered, entered into use, not only for food, but also for starch and the cotton manufactures, in aiding to form the weaver's dressing for warps, and for feeding stock. It had the advantage over most other grains, that it would keep good for years in its unhusked state, and for table use old rice was preferred to new. Owing to the wide extent of Indian territory available for rice culture, it was impossible for the grain crops to fail universally. Within the last 15 or 20 years, the province of Arracan had become the granary of a great part of India and Europe, and the rice garden of our eastern settlements. Increased land has been brought under culture, and the trade in produce had been steadily developed, until Arracan now competed with Bengal in the rice trade of the continent; and the exports, which in 1830 occupied only a few coasting vessels, in 1854 re-

quired more than 100,000 tons of shipping. The exports of rice from Akyab, which, in 1849, were only 65,000 tons, in 1853 exceeded 120,000 tons; while the Bassein district shipped 150,000 tons, making a shipment of 270,000 tons of food grain from one small quarter of the Arracan Province. Considerable quantities of rice were also shipped from Moulmein, from Tavoy and Mergui. From Madras the exports of rice in 1856 amounted to 118,334 Indian maunds (about 88.750 cwts.) From Calcutta the average exports were 200,000 tons a year, of which one-half came to Europe, one-fourth went to the Mauritius, and the remainder was shipped to Australia, North America, and other quarters. But in the paper they had just heard, various other important grains and pulse are enumerated; but these do not form a tithe of the food plants of India; and respecting the culture, yield, and comparative value of many of these, information was much sought, both in a scientific point of view and in the consideration of which of them it would be desirable to recommend the culture of in other quarters, such as in America and in our own colonies. This was a point to which his (Mr. Simmonds's) attention was often drawn, when in correspondence with foreign Agricultural Societies of which he was a member. One stumbling-block was the numerous vernacular names by which a particular plant or its grain was known in different localities in India. The native dialects were so numerous, and the name varied with the wet or dry crop, while the botanical name was so seldom given, that it was difficult to identify from the seed alone the numerous varieties of millets, and the pulses, passing under the common general name of Doll and Gram. This was a difficulty which he had met with in preparing the work on Vegetable Products which Dr. Watson had alluded to, for though he had been induced from the current interest of the food question at the time of publication, to devote a very large portion of the work to details connected with food plants, he had not been able to be so precise and accurate in his descriptions respecting the Indian grains and pulses as he could have wished. Some ten or twelve years ago he had endeavoured to diffuse information on the agriculture of Hindostan in a series of papers published in his *Colonial Magazine*, and although the subject had not then the importance with which it was now invested, still it had enabled him, in connection with the fine collection of grains shown at the Great Exhibition, the reports of the Madras Exhibition, and a study of Col. Sykes's observations on the cerealia of India, to master many of the difficulties which had previously stood in the way. A little work, on which he had been for some years engaged, a dictionary of trade products, which he hoped would be published in about a month, would probably be found useful to many, for in it the various names would be given under which different grains and pulse were known in the various districts of the East. With respect to the leguminous plant alluded to in his work, cited by Dr. Watson, he had not yet been able to obtain any definite information respecting it. At a meeting of the Society early last year, he had placed on the table, with numerous other specimens of grains and seeds, some of these large white Chinese peas from Shanghai, and which formed so large an article of commerce there. From the appearance of the pulse it certainly was not a Dolichos. That from Sumatra, shown to night, judging from the analysis of Dr. Watson, was well worthy of extended cultivation. Mr. Simmonds added that he had found no difficulty in raising varieties of Doll and Gram in his greenhouse, if sown at the proper season. Dr. Watson had stated the value of the whole of the grain exports of India at £889,000 for 1853. He thought this a very low estimate, looking at the statistics which he had cited of the rice exports alone, exclusive of other grain and pulse. Probably this arose from a very low official export value in the Customs records. The food resources of India, its capabilities of supplying home and export demands, connected as they would be with the cheaper transport to the towns and coast, arising from improved land and water communication, and greater facilities afforded to colonization and land settlement, were questions of the highest importance to India, to the adjacent colonies, and to Europe.

Dr. ROYLE said that the details of every one of the grains, alluded to by Mr. Simmonds, would be found in Dr. Roxburgh's Flora Indica as the result of examinations made at the beginning of the present century. In that work he believed every species of grain known in India was botanically treated of, as well as the mode of cultivation which each required.

The CHAIRMAN said, there was one point upon which he was sure the meeting would like to hear the experience of Indian gentlemen,—several of whom he saw present—that was, as to the influence which the various kinds of food throughout India exerted upon the character of the population. In the narrative of the recent travels of Dr. Livingstone it was worthy of observation that the character of the nations through which he passed depended upon the habits of the people in the acquisition of their food, as well as upon the food itself. For instance, the Kaffirs, who lived by hunting, and were flesh eaters, were wild and warlike. Then there were the Wampoos, who lived principally on grain, and were of a more quiet and peaceable disposition; then, again, there were the Bituanoes, who lived upon grain, were more civilised than the Kaffirs: and again, the Macololas, who combined as their food both grain and flesh; they did not lose the warlike character, and made incursions upon their more feeble neighbours. It was an axiom amongst the latter people that if it were not for the gullet (alluding to their appetites) there would be no war or fighting amongst mankind. In those parts, such as Loando, where the people lived upon starchy varieties of food, they had become diminutive in their stature, and this applied, not merely to the natives, but also to the Portuguese settlers there, for they had lost the physical characteristics of their ancestors, and had become feminine in their frames and habits; and this extended even to their handwriting. Where more nitrogenous food was taken the physical character of the people had not undergone that very marked change. It had been calculated that there must be thirty-six ounces of nitrogenous matter per week in the food of a man to make him fight. The Dutch soldiers in time of peace were allowed twenty-two ounces of nitrogenous matter, but they could not fight upon that; when required to fight they were allowed 36 ounces of nitrogenous matter per week. It would therefore be most instructive to hear what were the habits of the different nations in India with reference to their food—not merely the proportion of nitrogenous matter, but the amount of real flesh taken with their grain food. He felt quite confident that the Ghoorkas, those brave little warriors who had so much distinguished themselves during the late rebellion in India, partook of a large amount of nitrogenous food. He hoped Dr. Watson would discuss this interesting subject in his next paper, inasmuch as accurate data upon that point were very much wanted. As yet they had not sufficient to judge of the full effect of food upon the different races—not only as regarded the question of the food itself, but as to the mode of acquiring it, which also had an effect upon the character of a people. In illustration of this, he might take the people of Ireland. If they had a population depending upon a certain quality of food in which carbonaceous matter had an undue proportion to the nitrogenous matter, certain results must follow. In the first place, the wages of labour could not be high, and the state of the country must be low as long as the people continued to live upon such a character of food. Before a man could compensate for the expenditure of muscular power consequent upon a day's hard labour, he must eat from 14 to 15lbs. of potatoes; this was, in fact, impossible. A

man could not take more than 7lbs. of potatoes per day, and a woman 5lbs.—their bodies could not contain more. Therefore the labour so sustained was only half the value of that of the wheat-eating men of this country, who also ate flesh and labour-producing matter. Give an Irishman potatoes in this country, and an Englishman wheaten food, the very character of the diet would make the former worth only half the wages of the latter. It was the nitrogenous and flesh-forming matter which, in the competition of labour, gave the superiority to the English workman. But as he had before remarked, it was not only the description of the food itself but the habits of procuring it, that constituted the difference of the physical characteristics. When the Irish depended chiefly upon potatoes their labour was called for only twice in the year, namely, at seed time and harvest. During the rest of the year they had nothing to do; and, therefore, labour, instead of being steady and continuous was impulsive. In point of fact, the famine in Ireland was one of the greatest blessings that could have befallen that country. It caused them to depend less upon what had hitherto been the staple food of the people, and which had kept wages low and rendered labour impulsive: and it created a demand for other kind of food in order to avert a potatoe famine for the future; and thus labour became distributed over the year to the benefit of the Irish people as well as of this country. He would now say a few words with reference to the chemical part of the subject. Perhaps a little too much stress had been laid upon the nitrogenous theory of food. Liebig had shown them what the nitrogenous matter of food was, and the functions it performed in the building up of the frame-work of the body. The non-nitrogenous kept up the respiration and heat, but was not used in the construction of the frame-work of the human machine. Knowing therefore the discoveries of Liebig, and his process of thought during the time that those discoveries were made, from a constant correspondence with him at that period, he (the chairman) in lecturing upon those views had never intended to represent Liebig as saying that unless there was a due balance between nitrogenous matters and carbonaceous matters, the proper nutriment of the human frame could not be carried on. The case was just this—supposing they had a machine at work; it required iron for the frame work, coal for fuel, and steam for motive power. The machine could not do with any one of these elements alone; and if repairs were required, they must be effected with the same material as that which had been expended. They could not repair the iron frame with coal; they must use the same description of material. In like manner, the views of Liebig were that the nitrogenous matters were the nutritive matters of the machine, which formed the basis of our bodies, and the other materials, the non-nitrogenous matters, kept up the great functions of the body, producing not only vital heat, but the powers necessary to the action and motion of the machine. Dr. Watson had done great service to science by insisting upon a due proportion between the non-nitrogenous substances and the nitrogenous, but he (the chairman) did not quite agree with him as to the exact proportions of the two. Let it be taken that the proportion of flesh-forming ingredients to non-nitrogenous should be as 1 to 6, that would be only a rough approximation; for this reason—the non-nitrogenous matters were varied in their composition, whilst the flesh-forming were nearly always the same. It was of small consequence whether the flesh-forming matter was derived from one ingredient or another. Thus, in a hunt, they had an omnivorous man, mounted upon a graminivorous horse, accompanied by carnivorous dogs, pursuing a vegetable-eating hare or a flesh-eating fox. Therefore, whether the non-nitrogenous matter was got from vegetable or animal element, was indifferent But it was not so with regard to the heat-giving matters. There was one point which was especially perplexing to chemists—that was as to the quantity of fatty matter that was used in the food of people of hot climates, such as India. They could readily understand why fatty substances were largely consumed by the people of the Arctic Regions, in order to supply the fuel to keep up the bodily heat in cold climates, but with regard to India it was more difficult of comprehension. He (the chairman) thought that it might possibly serve to prevent the too great perspiration of the body, as they found in tropical climates it was the custom to smear the body with oil, to prevent the too rapid withdrawal of water from the system; and if the people partook of oleaginous matter it might possibly have a similar influence.

Dr. ROYLE said, when he was in the North-Western Provinces, he saw a good deal of the Ghoorkas, and he could state that in their habits of living many very nearly approximated to the European. They were fond of field sports, and were good marksmen with the musket, eating the game they shot, together with vegetable diet.

Mr. J. GRIFFITH FRITH, in adverting to the statement that wheat imported into this country from India was of little value in the market, mentioned that he had known that wheat to be sold at a very high price. The great evil with regard to the Indian wheat was, the presence of the weevil, in some cases to such an extent as to render the wheat almost valueless. He wished to inquire whether the hard or soft wheat was most subject to the attacks of that insect.

Dr. ROYLE remarked that, at present, entomologists were at a loss to account for the manner in which the insect got into the wheat. On the occasion of Professor Solly's analysis of wheat from the Nerbudda, the presence of the weevil was detected to a considerable extent. On examining the wheat under the microscope, small appearances were noticed, which seemed to indicate that the insect attacked the wheat in a growing state, but at what stage he was unable to say. The opinion of some entomologists was, that the wheat was attacked by the weevil when deposited in the granaries. Others were of opinion that the ova were deposited in the growing grain. Wheat had been sent from India to Australia without being attacked by the weevil.

Mr. PHILIP PALMER said, now that they were sending large bodies of troops from this country to India, it was important to know what effect, upon the constitution of Europeans, the use of these different grains as food would have. Each province of India had its peculiar food; and as they had been told by the learned chairman that a certain quantity of food was necessary for the performance of a given amount of labour, it became a matter of interest to know how their countrymen, now going out to India, would fare in that respect, and what description of food would be given them.

Dr. WATSON replied that the food supplied to the soldiers in India did not differ materially from that to which they were accustomed at home. About the same proportion of flesh was allowed. However, he thought, if Europeans assimilated their diet more to that of the natives it would be beneficial to them.

Mr. RIDDELL mentioned that when in India he had always understood that considerable quantities of wheat were exported to England. At the same time, he believed it would be found that this was only the case when that commodity was fetching a very high price at home, for he was of opinion that the Indian was not worth more than two-thirds of the value of English wheat. That it was wanting in the nutritive power possessed by the English grain there could be no doubt. He thought one reason for this was the difference in the length of time in which the grain came to perfection. In India the wheat was sown after the rains, and three months afterwards it was reaped. Until means of communication were opened in India, from the interior to the coast, it was not worth while to export wheat. Indeed, in many parts of the country where wheat was most plentiful, even if it could be obtained for nothing, the expense

of conveyance to the coast would be so great that it would not be worth the cost of carriage.

Mr. Thomas Scott remarked, that in a country like England, where they had the fullest means of selecting the diet which they preferred, the elaborate research which they saw before them in the tables now exhibited might appear a useless work; and he had heard the same remark applied to the able paper of Dr. Letheby on a similar subject read last session. It, however, must be admitted that the results obtained were most important. But, leaving man out of the question for the moment, and taking the various articles applicable to the food of domestic animals, they had, by inductive reasoning, arrived at the most invaluable results. Thus, in the feeding of animals they now were able to supply the food in the first instance which contained the elements for building up the frame of the growing animal, and afterwards food containing different elements for the fattening of the mature animal. Again, with regard to vegetable physiology, they were all aware of what had been done by Liebig as to the management of the feeding of plants. It was scarcely necessary to follow out the argument of the learned chairman that the character of a people was regulated by the food on which they lived. He (Mr. Scott) had employed many hundreds of Irish labourers, and when they arrived here, and took a different kind of food, their labour, which was worth only 10d. per day in Ireland, was worth 3s. 6d. in this country and was, moreover, more profitable to their employers at the higher than at the lower sum. The famine in Ireland had created an entire revolution in the domestic and social economy of that country. They ceased to regard the potatoe as the staple article of food. A demand upon the labouring population was made, and the character of the agriculture of the country was altered. It was now the case that almost everywhere the people sold their potatoes, as well as the whole of their oat crops, with but few exceptions. The better class of labourers used to eat oatmeal, but now they took maize, because it enabled them to work better. It was desirable to feed the labourer with food that was proper for the demands made upon his muscular energies; but it was necessary, in the first place, to create a taste for that food.

The Chairman said, in proposing a vote of thanks to Dr. Watson, he could not avoid expressing his opinion that it was most important for the interests of India that this investigation should be further pursued. Dr. Watson had only got a certain way, although it was astonishing the amount of work he had accomplished in the few months during which he had been employed in these researches. It would be a great boon to India to continue the experiments so well begun. It was not always the case, that if the palate appeared to indicate that certain things were suitable, they could always follow the dictates of nature, because large bodies of men had no choice of food. This was especially the case with soldiers and sailors, and in our workhouses and prisons. Large masses of the people lived upon dietaries arranged by government, and there never was a more remarkable instance of the effect of a want of knowledge of these subjects—than was shown in the dietaries of our prisons, where men received an amount of nitrogenous matter in their food, varying according to the periods of confinement, and not according to the work that they had to perform in prison. The arrangement of dietaries by government ought to be made according to the last discoveries of science. Although there were still difficulties in the question, they knew sufficient to regulate those matters much better than was done at present. He hoped Dr. Watson would receive encouragement from the public, and from the East India Company, to continue these valuable researches, and that he would not find it necessary to give up so useful an inquiry in order to attend to his military duties. He begged to propose a vote of thanks to the author of the paper.

A vote of thanks to Dr. Watson for his paper was then passed.

In returning thanks, Dr. Watson said there was one fact mentioned by Mr. Riddell, of the greatest importance—namely, the successful cultivation of the gram in this country, which in course of time might supersede the various expensive products now received from Egypt. He thought the hint thrown out by Mr. Riddell ought to be taken advantage of, as he felt confident an admixture of the gram with other food for horses, would produce a better diet than was at present used.

The Secretary announced that on Tuesday evening, the 1st of December, at seven o'clock, a Special General Meeting of the Society would be held, to which Members only would be admitted, and that at the Ordinary Meeting on Wednesday evening next, the 2nd of December, a Paper, by Mr. Apsley Pellatt, "On the Relative Heating Powers of Coal and Coke, in Reference to Economy in Fuel and the Smoke Nuisance," would be read.

SILVER IN SEA-WATER.

By Prof. S. Bleekrode.

In the early part of this year Professor Faraday related to the Royal Society the experiments of Mr. Field respecting the presence of silver in sea-water. That silver could be detected in sea water had already been shown by Malaguti, Durocher, and Sarzeau. Their calculation was that it contained 0·00000001 per cent. They detected one milligramme in a hundred litres of salt water from the canal at St. Malo, and also in the ashes of seaweeds: in the *Fucus serratus*, 0·00001, and in *Fucus ceramides*, 0·00000001 per cent. of silver.

From the solubility of chloride of silver in chloride of sodium (sea salt), Mr. Field suggested that the silver in that form was dissolved in sea-water, and would be deposited upon copper or yellow metal by the known galvanic reaction. He also observed that that would be likewise the case with the sheathing of ships. Mr. Field analysed 5,000 grains, and found in one case the amount of silver to be 10oz. 2 dwt. 15 gr. Tr. per ton, or 35·326 grains per 1,000 kilogs., and in the other 7 ozs. 13 dwt. 1 gr. Tr. per ton, or 238·006 grains per 1,000 kilogs. I have analysed two different portions of yellow metal, being the worn-out sheathing from Dutch ships in the East Indian trade. The quantity analysed was 1 kilog. (= 2 lbs. 8 oz. 3 dwt. 0·3 gr.) in both cases. The result was:—341 grains per 1,000 kilogs., and 271 grains per 1,000 kilogs. The amount of silver will not be constant, because the sheathing is covered with sand, lime, and other materials, and these cannot be separated without some chance of loss. This communication may possibly confirm the observations of others.

SMOKE CONSUMING FIRE-PLACE.

A smoke-consuming fire-place for ordinary purposes in dwelling houses has been invented by M. Touet Chambor, of Paris. The fire-place consists of a plate of cast iron, bent over at the top at one-third of its height, and surrounded by an iron frame similar to that employed in ordinary fire-places. Attached to this is a cast-iron basket, in which the fuel is placed. The back of this basket is furnished with vertical bars, through which the products of combustion pass into a chamber in the chimney at the back of the grate, the fuel burning with a descending current and the smoke being thus burnt or consumed. In the chamber at the back of the grate is placed a system of tubing, one end of which communicates with the open air, the other with the room to be

warmed. The heat from the fire, being conducted over this tubing, warms the air in its passage through it into the room. At the back of the vertical bars an iron plate slides up and down, so as to regulate the amount of opening into the chamber at the back and thus increase or diminish the draft. In the upper and bent portion of the iron plate are two openings into the chimney with sliding doors or registers. These registers, in conjunction with the sliding plate at the back of the fire-place, assist in regulating the draft through the fire and over the tubing. By lowering the sliding plate and opening the register above, the grate becomes at once an ordinary open fire-place, the flame and smoke ascending through the chimney in the usual way. By closing the upper register, partially or wholly, as may be found necessary, and raising the sliding plate, the action of the draft becomes at once reversed, the smoke is consumed, and in addition to the radiated heat from the open fire, the play of the flame and heated gases on the tubing causes warm air to pass into the apartment. This tubing, from its size and length, and the continued flow of cold air through it, is kept comparatively cool, and though made of thin sheet iron is stated never to get over-heated, and is thus preserved from destruction. The fire-place is adapted to burn wood, coal, coke, and every variety of fuel. It is not easy to give a very intelligible description of this fire-place without diagrams, but if any member of the Society desire further information, the Secretary will be happy to place them in communication with M. Touet Chambor, who is now in London, and will show the stove in action.

Proceedings of Institutions.

Macclesfield.—The twenty-second annual meeting of the Useful Knowledge Society, was held in the Town-hall, on Tuesday evening, Nov. 10, when prizes were awarded to the most successful students in the various classes. Samuel Greg, Esq., one of the vice-presidents of the Society, occupied the chair, in the absence of the president, J. Brocklehurst, Esq., M.P. On the platform were—the Mayor (F. Jackson, Esq.), the ex-Mayor (W. Bullock, Esq.), C. Egerton, Esq., M.P., Rev. W. C. Cruttenden, Rev. W. R. B. Arthy, Joshua Fielden, Esq., of Todmorden; Mr. T. U. Brocklehurst, Mr. C. Brocklehurst, Mr. John May, and Mr. Potts. The room was well filled. The Chairman, after addressing the meeting, called upon the Honorary Secretary to read the report of the Committee. One of the first subjects to which their attention had been drawn after their election to office, was a revision of the rules of the Society, and in the performance of this duty the Committee availed themselves of all the information they could obtain from the rules of similar Societies in other towns, and they have thus been enabled, after much labour and mature consideration, to frame and submit to the members a new set of rules and regulations, which they believe are applicable not only to the present position of the Society, but also to any varying circumstances which may hereafter arise. The Committee much regret that the readings and lectures during the past year have been so scantily and poorly attended, and that they have therefore been obliged to decline making any new engagements with lecturers. The classes, however, continue to be well and diligently attended, and the progress of the pupils, both male and female, (as is shown by the teachers' reports,) has been and is still most satisfactory. With respect to the library, the Committee report that they have increased it by the purchase of about 200 volumes, in addition to several donations. The number of volumes issued during the past year has been about 12,300, and in this issue, the more solid and instructive works have borne a just proportion. The Committee have much extended the utility of the News and Reading-rooms by the introduction of additional newspapers and periodicals. Special thanks are due to E. C. Egerton, Esq., M.P., for a donation of £50, which, with another £50, part of the last year's balance in the hands of the Treasurer, has been applied in reduction of the debt on the Society's premises. The Committee also thank Mr. Egerton for a donation of £5 5s. for prizes for the pupils, and for his promise of annually repeating this donation. After the reading of the report, Mr. Egerton addressed the meeting, and was followed by Mr. T. U. Brocklehurst. The distribution of the prizes to the successful students then took place, the Chairman and Mr. E. C. Egerton taking part in the proceedings, and addressing a few words of commendation and encouragement to the several recipients. The reports of the class teachers were then read, which shewed that the classes had been largely and diligently attended. The meeting was afterwards addressed by Mr. Greg, the Mayor, Mr. John May, the Rev. W. R. B. Arthy, Mr. Joshua Fielden, the Rev. W. C. Cruttenden, Mr. Potts, Mr. Charles Brocklehurst, Mr. Wright, Mr. Bullock, Mr. Jesper, and Mr. Curwen. After passing the usual votes of thanks the meeting separated.

Nailsworth.—The present session of the Literary and Mechanics' Institute was inaugurated by a soirée, which took place on Tuesday, the 13th October, at the Nailsworth Subscription Rooms. Mr. J. E. Barnard, who has been president of the Society from its commencement, having resigned that post, the opportunity of the opening festival was taken to present him with a testimonial,—a handsome silver inkstand, subscribed for by the whole body of the members. M. H. Whish, Esq., the President of the Institute, occupied the chair; and the room was well filled. The Chairman commenced by referring to the loss of Mr. Barnard as their president, and to the removal from the neighbourhood of one of their most active supporters, Mr. Anstie. They had to congratulate themselves on the fact that though the novelty of the institution had passed by, yet the Society still held its own. It was very much the case that institutes which flourished at first, languished after a little time when their first and principal supporters died and fell away; but they had kept on very well, and had more than balanced their expenditure by their receipts. It was a matter of satisfaction that several gentlemen and ministers of the neighbourhood had given them their countenance, and favoured them with lectures. Mr. Sibree was then called upon to address the meeting. Mr. Whish had put into his hand a subject on which to speak,—Free Discussion—its influence on the national character. He feared that an important branch of their Society—the discussion class—was not in so vigorous a condition as formerly. Free discussion had an important influence on the national character. Without the discussion of principles, no great advance would be made in any branch of knowledge. It had been said that man is naturally a contentious animal, and Hobbes had affirmed that the natural condition of mankind is war. He believed that to a certain extent that was true, though it should be a war of discussion, of opinion,—that war whose issues are in truth, and in all the great advantages which are connected with truth. Free discussion might be conducted with very little profit, for discussion should always be founded upon knowledge. It ought to lead to knowledge, and if it did not, it was of comparatively little value. Referring to the Indian question, he thought that the members should more especially cultivate those branches of knowledge connected with that subject. There would come a time—and that not far distant—when the subject would be thrust upon their attention, and they would have many facilities during the winter to study its bearings and interests. In presenting the testimonial to their late president, Mr. Bruton referred to the past history of the Institution. He remarked that those who had invested money in the building ought to be satisfied with the happy sight they then and at other times witnessed, and

accept that as a sort of interest for their investment. He concluded by referring to the great services that Mr. Barnard had rendered to the Institution. That gentleman then returned thanks, and said their success was mainly attributable to the unity and cordiality always exhibited amongst the members of the society. The meeting was afterwards addressed by the Rev. E. N. Maugin, Mr. Lycett, Mr. W. Barnard, and other gentlemen, and concluded by passing a vote of thanks to the Chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal, 4. Anniversary.
Actuaries, 7. Mr. Willich. I. "On a New Formula for the Expectation of Life." II. "On the Value of Life Annuities yielding a given Rate of Interest, the Capital to reproduce the Purchase Money being invested at another Rate."
Architects, 8. Mr. W. A. Boulnois, "On the Foundations of some of the Metropolitan Bridges in the River Thames."

Tues. Society of Arts, 7. Special General Meeting.
Civil Engineers, 8. Renewed discussion on Mr. Molesworth's Paper, "On the Conversion of Wood by Machinery;" Mr. T. S. Sawyer, "On Self acting Tools for the Manufacture of Engines and Boilers."
Pathological, 8.

Wed. Society of Arts, 8. Mr. Apsley Pellatt, "On the Comparative Heating Powers of Coal and Coke, in regard to Economy of Fuel and the Smoke Nuisance."
Geological, 8. Mr. H. D. Sorby, "On the Structure of Crystals, as applicable to the Determination of the Aqueous or Igneous Origin of Minerals and Rocks."

Thurs. Zoological, 3.
Antiquaries, 8.
Chemical, 8. I. Dr. Muller, "On Rosolic Acid." II. Mr. F. Field, "On the Arseniates of the Earths."
Linnean, 8. I. Mr. Garner, "On the Shell-bearing Molluscous Animals, particularly with regard to Structure and Form." II. Mr. Cobbold, "General Observations on *Entozoa*, with notices of several new species, including an account of *Tænia serrata* and *T. cucumerina*." III. Mr. Sclater, "On the Fauna of New Guinea."
Philological, 8.
Photographic, 8.

Sat. Asiatic, 2.
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November* 20.]

Dated 5th October, 1857.

2552. James Coombe, Belfast—Improvements in machinery for hacking and preparing flax and other fibrous substances.

Dated 16th October, 1857.

2648. David Guthrie and Joseph Vavasseur, New Park-street, Southwark—A machine for cutting, chipping, or rasping dye-woods or other similar fibrous substances, for the purpose of obtaining extracts.

Dated 21st October, 1857.

2686. Robert Clark, Glasgow—Improvements in effecting the consumption or prevention of smoke, applicable to steam boilers and other furnaces.

Dated 22nd October, 1857.

2694. Marc Antoine François Mennons, 29, Rue de l'Abbaye-Montmartre, Department de la Seine, France—Certain improvements in machinery for the preparation of peat. (A communication.)

Dated 24th October, 1857.

2708. James Thom and Hugh McNaught, Glasgow—Improvements in looms for weaving.

Dated 4th November, 1857.

2797. Richard Laming, Hayward's Heath—Improvements in purifying gas and in apparatus useful for that purpose.

2799. Francis Higginson, Woodlands-cottage, Woodlands, Hants—Submerging, extending, and laying down submarine, electric, magnetic, and every other description of submerged or immersed electrical telegraph cables, wire ropes, and combined wire, gutta percha, spun-yarn, or other compound electrical cables whatsoever.

2801. Romain Ignace Charles Dubus, Brussels—A method of treating certain plants or vegetable substances, in order to extract from the same, 1st, a kind of fecula or farina proper both for alimentary and finishing or starching purposes; 2nd, an alcoholic liquor; and 3rd, a natural ferment or yeast.

2803. Charles Clay, Walton, near Wakefield—Improvements in machinery for grubbing or cutting up weeds and otherwise scarifying and cultivating land.

2805. Joseph Miller, Alpha-road, Regent's-park—An improved arrangement of marine steam engines.

Dated 5th November, 1857.

2807. Joseph Bunnett, Deptford—Improvements in machinery for banding and shaping metals.

2809. George Robinson, High street, Deptford—Improvements in apparatus for shelling or hulling coffee and other berries and seeds.

2811. John James Cousins, Park-lane, Leeds—Improvements in the construction of steam ploughs.

2813. William Sharman, Sheffield—An improved metallic compound, applicable to the manufacture of useful and ornamental articles for which German silver and compounds resembling German silver are at present used.

Dated 6th November, 1857.

2815. Frederick Lipscombe, Strand—Improvements in the mode of conveying water and other liquids.

2817. Germain Canouil, Paris—Improvements in the manufacture of matches.

2819. Henry Bessemer, Queen street-place, New Cannon-street—Improvements in the manufacture of malleable iron and steel, and also in the manufacture of railway bars, and other bars, plates, and rods from iron or steel so manufactured.

Dated 7th November, 1857.

2821. Hugh Baines, Manchester—Improvements in machinery or apparatus for the prevention of accidents, applicable to hoisting and other lifting machines.

2823. John Henry Pepper, Royal Polytechnic Institution, Regent-street—Improvements in displaying various devices when revolving discs or surfaces are used.

2825. William Wilson, 1, Canterbury-place, Newington, and James John Joseph Field, 11, Sussex-street, Wandsworth-road—Improvements in casting or moulding liquified and other substances.

Dated 9th November, 1857.

2827. Walter Hardie, 6, Pitt-street, Edinburgh—An improved stereoscope.

2829. Pier Alberto Balestrini, Brescia, Italy—Improvements in machinery and apparatus for paying out submarine telegraph cables, and for regulating and controlling the paying-out thereof.

2833. George Weedon, Gloucester-place, Portman-square, and Thomas Turner Weedon, Plumstead—An improved knife-cleaning machine.

2835. John Reeve, 46, Rutland gate—Improvements in propelling vessels.

Dated 10th November, 1857.

2837. Thomas Rowcliffe, 26, Upper Park-place, Dorset-square—Improvements in machinery for making and pressing bricks, drain pipes, and tiles, and in preparing material to be used for such like purposes.

2839. Joseph Townsend, Glasgow—Improvements in the manufacture or production of sulphurous acid.

2841. John Thomas Way, Welbeck-street, Cavendish-square—Improvements in obtaining light by electricity.

2843. Henry Critchett Bartlett, Ampthill-square, Hampstead-road—Improvements in the manufacture of paper.

INVENTIONS WITH COMPLETE SPECIFCATIONS FILED.

2849. Edward Halliday Ashcroft, Massachusetts, U.S.—An improved mode of preventing the over-heating and bursting of steam-boilers. (A communication.)—11th November, 1857.

2879. John Gedge, Wellington-street South, Strand—Improved means for stopping or retarding carriages used on ordinary roads. (A communication.)—17th November, 1857.

WEEKLY LIST OF PATENTS SEALED.

November 20th.

1423. James Abbott, jun., Richard Handley Thomas, John Young, and James Edward Hunt.
1424. Joseph Jakens.
1434. William Todd.
1453. William Carron.
1458. Thos. Humphrey Roberts.
1459. Thomas Silver.
1460. Gautier Olivier de la Barre.
1461. John Phillips.
1478. William Scott Underhill.
1606. William Wright.
1634. Alfred Vincent Newton.
2230. Frederick Albert Gatty.
2508. Rudolph Bodmer.

November 24th.

1464. William Robertson.
1489. Robert Parkinson and John Standish.
1491. William Irlam Ellis.
1492. Henry Crompton.
1497. Jean Leonard Codet-Négrier.
1499. Randal Cresswell.
1502. Richard Archibald Brooman.
1509. Richard Edward Hodges.
1509. William Hale.
1515. Alexander Simpson.
1516. William Wilber.
1521. James Merrylees.
1555. James Stevens.
1562. William Jones.
1567. John Jobson.
1579. Richard Roberts, Wright Shaw, and Samuel Shaw.
1599. Alfred Jean Vincent Dopter.
1605. William Wright.
1630. Arthur Dunn.
1636. George Farrell Remfrey.
1642. Joseph Michell Paule.
1681. William Edward Newton.
1692. Salomon Sturm and Henry Emile Bour.
2182. Peter Carmichael.
2250. John Penn.
2265. Thomas Brown.
2292. Henry Rawson.
2407. Emile Alcan.
2451. Daniel Forrester.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

November 16th.

2433. William Low.
2442. George Tomlinson Bousfield.

November 17th.

2449. Edouard Belmer.
2451. Henry Diaper.
2459. William Beasley.

November 19th.

2496. Joseph Gillott, jun., and Henry Gillott.
2542. Joseph Maudslay.
2564. Albinus Martin.

November 20th.

2481. Samuel Alfred Carpenter.

Journal of the Society of Arts.

FRIDAY, DECEMBER 4, 1857.

SPECIAL GENERAL MEETING.

Tuesday, December 1st, 1857.

A Special General Meeting of the Society, was held on Tuesday evening, the 1st inst., at seven o'clock.

Mr. C. Wentworth Dilke, chairman of the Council, said, that it appeared to his colleagues and himself, that it would be more becoming on this occasion, when undoubtedly the conduct of some of the Members of Council might be considered to be under discussion, to place in the chair some member unconnected with either side. He should, therefore, before he sat down, propose a gentleman whose name would, he believed, be satisfactory to all. Mr. Dilke said he had been instructed by the Council to have before him the Minutes of Meetings of Council, and of the Board of Examiners and other Committees, in case the chairman or any gentleman might wish to have them referred to. The Council had also invited the representatives of the Press to be present. Mr. Dilke then proposed that Mr. W. H. Bodkin should take the chair.

This motion, having been seconded by Mr. Matthew Marshall, was carried unanimously.

Mr. Bodkin, having taken the chair, said, it appeared to those who felt it to be their duty to call the meeting that it was desirable the chair should be occupied by one who had taken no part whatever in the discussions which led to the meeting. Being an old member of the Society, and feeling desirous to be serviceable to it, he hoped this circumstance would acquit him of what, under other circumstances, might appear presumption. He should endeavour to perform his duty impartially, and if it was a recommendation that he knew nothing of the subject to be discussed beyond what he learned from a hasty perusal of the papers, he possessed that recommendation. He trusted that the discussion would be conducted in a conciliatory spirit, and in a manner in keeping with the character of the Society.

The Secretary read the Bye-laws relating to General Meetings of the Society, and those relating to the alteration of Bye-laws, as well as the following advertisement, inserted in the Society's *Journal* and in the newspapers, convening the meeting.

"SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

"The Council hereby convene a Special General Meeting of the Members of this Society, to be held on Tuesday, the 1st of Dec., at 7 o'clock, p.m., for the following purposes:—

"1. To revoke the five existing Bye-laws which relate to the Board of Examiners, and to make and adopt other Bye-laws in the place thereof.

"2. To consider the amended and extended scheme of Examinations which the Council propose to carry out in concert with the Institutions in Union.

"3. In compliance with a requisition received from certain members, 'to take into consideration and decide on the propriety of continuing to hold Local Examinations of the Members of Mechanics' Institutions, and similar societies, and to award certificates of merit accordingly.'

"4. And, generally, to pass such resolutions as may express the sense of the Meeting in relation to all or any of the beforementioned subjects.

"By order of the Council,
"P. LE NEVE FOSTER, Secretary.
"Society's House, Adelphi, London, Nov. 23, 1857."

The Secretary produced the notice of the meeting, which, together with a copy of the proposed new Bye-laws, had been suspended in the Society's room for the required period.

The Secretary then read the following report from the Council:—

"The Council consider that it will conduce to the convenience of members to give a brief summary of the points which they have proposed should be brought before the present Special General Meeting.

"The first subject is the legality of the present Bye-laws affecting the Examinations.

"Members will bear in mind that these Bye-laws are new, having been passed as recently as last February; and, during the past month of November, were, for the first time, about to come into operation. The attention of the Council was drawn to the fact, that the Bye-laws were contradictory to the Charter—that they were illegal. That they are illegal, the solicitor of the Society, who is now present, will assure the members if they entertain any doubts upon the subject.

"The Council submit to the members the expediency of passing new Bye-laws. The proposed new Bye-laws simply place the Board of Examiners under the control of the Council, as they were before the Bye-laws attempted to remove them from that control.

"The Council repudiate altogether the slightest intention of disrespect to the Examiners, in suspending their functions in order to prevent an election of them contrary to the Charter.

"The Council place, with confidence, their Programme of Examinations before the members at large."

Mr. Edward Baines said, as president of the Yorkshire Union of Mechanics' Institutions, he had consented to take charge of some memorials which it was now his duty to present. He felt called upon to state that, a report having reached the Institutions which he represented, that the Society contemplated discontinuing the Examinations, a form of petition was agreed upon and sent round to the various Institutions of the Yorkshire Union. He felt necessary to take up the time of the meeting in reading this memorial, though he was sorry to say it was agreed to before they were acquainted with all the facts of the case, and he wished the meeting to know the exact truth as to the circumstances under which this memorial had been signed. Mr. Baines then proceeded to read the following memorial:—

"To the Society for the Encouragement of Arts, Manufactures, and Commerce.

"We, the undersigned members of Mechanics' Institutes comprised in the Yorkshire Union, have heard with feelings of deep regret that the Council of your Society have resolved to discontinue the Examinations, and thereby to deprive them of that stimulus to application in class instruction which they had reason to believe would have been continued from year to year; and they were fortified in this opinion from the success which has already been achieved, and which must have fully realised the most sanguine anticipations of all who have taken part in this important movement. Your memorialists are of opinion that no step which has yet been taken to influence the extension of mental cultivation, by means of Mechanics' Institutions, has been so practically beneficial as the stimulus afforded by the Local Examinations of the Society of Arts, and they entertain the most confident belief that the advantage to be gained in the future will be greater than has yet been accomplished, if the examinations be continued, and their usefulness extended by increasing the number of local centres. Your memorialists, therefore, beg respectfully but urgently to entreat that the good work thus auspiciously begun may be continued, and that from year to year they may enjoy the solid advantage of an examination in which the merits of the respective candidates are efficiently tested, and the only practical stimulus given to instruction in the Evening Classes of the several Institutes."

The memorial was signed as follows:—Ackworth Me-

chanics' Institute, 26; Almondbury, 64; Batley, 142; Barnoldswick, 37; Barnsley, 28; Bingley, 58; Brighouse, 81; Boston Spa, 10; Calverley, 44; Churwell, 57; Dewsbury, 57; Dogley Lane, 32; Doncaster, 156; Eccleshill, 36; Gomersal, 144; Halifax, 77; Headingley, 20; Hebden Bridge, 76; Helmsley, 22; Hepworth, 23; Holbeck, 41; Honley, 62; Hunmanby, 12; Keighley, 83; Kirkby Malzeard, 10; Knottingley, 27; Leeds (memorial of similar purport), 126; Ditto, East Ward, 101; Ditto, West End, 71; Lockwood, 72; Masham, 29; Milnsbridge, 42; Mossley, 51; Northowram, 71; Pudsey, 114; Redcar, 41; Richmond, 74; Rotheram, 70; Selby, 87; Shelley, 66; Southowram, 44; Thirsk, 49; Tickhill, 34; Wakefield, 70; Wilsden, 36; Woodhouse, 112;—making a total of 2,784 signatures.

He had also a memorial of the same nature from the Huddersfield Mechanics' Institution, signed by 459 members. This place, it would be remembered, was selected as the centre of provincial Examinations last year, and from that circumstance peculiar importance attached to that memorial. He thought it only right to state that these memorials were founded upon the supposition that it was the determination of the Council of the Society of Arts to abolish the Examinations altogether. Upon learning the real state of the case, he immediately caused a meeting of the committee of the Yorkshire Union to be convened, by whom the following resolutions were passed:—

"Resolved—That the committee learn with pleasure that it is not the intention of the Council of the Society of Arts to discontinue the Examinations, but rather to extend them as far as possible. The committee, however, regret to find that the Council contemplate abandoning the oral Examinations, and propose to conduct the examinations solely by printed questions sent down to the respective Institutes. They cannot but fear that this method will fail of success, and endanger even the continuance of the Examinations:—

"1. Because examination papers alone, without the assistance of oral examinations, cannot satisfactorily test the attainments of the students.

"2. Because without the presence of Examiners from the Society of Arts, there will be a liability to local partiality and unfairness, and the Examinations and Certificates will lose much of their importance in the estimation of the students.

"3. Because the personal visits of the Examiners to the various localities serve to excite interest in the officers and friends of the Institutes, and to vitalise the whole movement.

"4. That no practical obstacle seems to exist in the way of continuing and gradually extending the Examinations in the form in which they have been found to succeed so well; inasmuch as the highly competent men hitherto employed as Examiners are willing to visit the localities, and the Society possesses funds, derived from the Mechanics' Institutes, to enable them to remunerate those gentlemen for their services.

"Resolved—That this committee think it their duty to express their high sense of the zealous exertions of the Rev. Dr. Booth in introducing and conducting the examinations, to which exertions they cannot but mainly ascribe the success realised, and the public interest excited; and they would consider it a serious loss if the Institutes should be deprived of his services."

Mr. Wyndham Portal, who represented the Institutions of Hampshire and Wiltshire, presented the following memorial, signed by the secretaries of the Hants and Wilts Adult Education Society:—

"The undersigned, the secretaries of the Hants and Wilts Adult Education Society, are anxious to express their readiness to co-operate in any way with the Society of Arts, in promoting and carrying out their Examinations. They are glad that it has been determined to confine the Examination to written papers, as it will enable the Society with ease and facility more widely and efficiently to extend the Examinations. The plan which has been adopted by the Hants and Wilts Adult Education Society, is referred to, and explained in, the following extract from the Society's report, presented October, 1856. There has never been the slightest reason to believe that the Examinations, under these provisions, have not been conducted fairly and honestly:

'The method of conducting the Examinations was as follows:—An application was made to the president of the Institution to which the candidate belonged, requesting his assistance in the nomination of three members, one or other of whom would be present during the whole of the Examination, and report that the answers of the candidates were given without any aid or assistance whatever. The whole was in writing. Two hours in the evening were fixed upon by the president, and allotted to each paper of questions, which was sent by that day's post to the president, sealed, and with a special direction on the cover, that they were to be opened in the room. The answers also were to be sealed up in the room, and returned with a certificate from the manager to the secretary by the post.'

"This plan has the peculiar advantage of bringing home the Examination to each candidate, without cost of time or expense. While venturing to bring their own practice before the Society, the memorialists would wish it to be understood that they state it only for consideration, but that they are ready in every way pointed out by the Society to promote its objects, and to place their services at its disposal. Small local districts may readily be formed, if it be thought desirable, and in this their local knowledge might, perhaps, be available in the two important counties their operations embrace. If, on the other hand, it be determined to conduct the Examinations locally in each Institute, they will willingly undertake to aid in securing fairness and fidelity in the Examinations in all the Institutions in union with the Society of Arts, and the Hants and Wilts Adult Education Society in the district for which they act. While hailing with the greatest satisfaction the measures recently taken by the Universities, they would express an earnest wish that through the recommendation of the Society of Arts, or those friendly to such an extension, the age for the second or higher examination could be extended to 21 or even to 25 years. To render the boon granted by the Universities efficient for the purposes proposed, the extension would appear to your memorialists indispensable, inasmuch as it is intended to include those who, from a variety of circumstances, would never be able to receive a University education, and to whom, therefore, ample time and every opportunity and encouragement should be given to present themselves for Examination."

The Secretary then read letters enclosing resolutions in favour of the continuance of the Examinations, which had been received from the following Institutions:—Tailor's Labour Agency Literary Institute; Hitchin Mechanics' Institution, deprecating any essential charge in the mode of conducting the Examinations; Lewes Mechanics' Institution; Manchester Mechanics' Institution, approving of the system carried out at Huddersfield, and deprecating any change; from the Wenlock Agricultural Reading Society; two letters from the Birmingham and Midland Institute, the first containing a resolution expressing their regret that the Society appears to contemplate the abandonment of the Examinations, and the second acknowledging the receipt of the Programme, and expressing their satisfaction at finding that their apprehensions were without foundation; from the Portland Breakwater Mechanics' Institution, expressing their entire concurrence in the course adopted by the Council; from the People's College, Sheffield, acknowledging the receipt of the Programme, and cordially concurring with the arrangements proposed by the Council.

Mr. James Glaisher, F.R.S., said, he believed that a letter had been received by the Council from Colonel Sykes, and he was desirous that it should be read to the meeting.

The Chairman ruled that the reading of the letter would be out of order.

The Secretary then read the Bye-laws proposed to be revoked, as follows:—

XII. The Board of Examiners.

62. "To carry into operation the system of Examinations established by the Society, a Board of Examiners shall be elected from year to year in manner and form following:—On the first Wednesday in November, in each year, the Secretary shall summon all the members of the Board of Examiners to a meeting, due notice thereof having been previously given; and the members assembled, three being a quorum, shall proceed to nominate the persons whom they propose to be members of the Board of Examiners for the ensuing year. The Secretary shall cause a list of the names, thus proposed, to be printed and sent to each member of the Board, duly summoned, at the same time, to attend a meeting of the Board of Examiners on the second Wednesday in November. The Board of Examiners shall then proceed to select by ballot the persons who are to constitue the Board of Examiners for the ensuing year. No person shall be so selected unless he shall have had a majority of the votes of the persons then present and voting. The Chairman of the Board of Examiners shall certify, under his hand, to the Council the names of the persons so selected to act as the Board of Examiners of the Society of Arts. The list of selected names being submitted to the Council, duly summoned, for confirmation, it shall be competent for the Council to erase the name or names of any of the proposed Examiners from the list; and having confirmed the remainder, and appointed them to be the Board of Examiners for the ensuing year, to require them to proceed to nominate other fit persons to supply the vacancies in the Board of Examiners.

63. "Whenever a vacancy shall from time to time occur in the Board of Examiners, it shall be competent for the Board, duly summoned, to proceed to nominate, in the manner before described, a person to fill the said vacancy; and on his election being confirmed by the Council, he shall be admitted a member of the Board.

64. "Should the Council at any time, on the representation of the Board of Examiners, think proper to increase the number of Examiners, the election shall take place in the manner before described.

65. "The Board of Examiners shall elect a Chairman on the third Wednesday in November. He shall be elected by ballot. The Chairman of the Board of Examiners shall, *ex officio*, be entitled to be present at all meetings of the Council, and shall be duly summoned thereto.

66. "The Board of Examiners shall not vacate office with the Council, Officers, and Committees annually in June, but shall continue to hold office until the appointment of the succeeding Board in November.

Mr. Harry Chester said, he had been requested by his colleagues in the Council to move the first resolution, and he would endeavour to do so without heat and without personality. As far as the Council and himself were concerned, they desired the discussion to be confined as strictly as possible to the business before them. The present meeting had been convened for the purpose of considering the expediency of repealing the five existing Bye-laws relating to the Examiners and substituting four others in their place; also to consider the Programme of Examinations which the Council had issued, and to take into consideration a requisition which had been received from Institutions in the North; and to pass such resolutions upon any or all of these matters as the meeting deemed proper. He begged to state at the outset that no question as to the continuance of the Examinations had ever been raised by the Council. They were obliged, under the Bye-laws, to include that subject in the notice for this evening's meeting, inasmuch as a requisition duly signed had been sent in to that effect; but if that question were put to the meeting, the Council, he need hardly add, would unanimously vote for it. It must be evident to all who had heard what had taken place, that a very large amount of misapprehension had prevailed as to the proceedings and the intentions of the Council in this matter, and he was glad to have heard the explanations with which Mr. Baines introduced the memorials he had presented. The only resolution which the Council had to propose was that of the revocation of Bye-laws which they believed to be illegal, and the substitution of others which they considered to be in accordance with the Charter of the Society and suited to its present circumstances. The Bye-laws, which they proposed to revoke, had been read, and those which they proposed to substitute he would read, in formally proposing their adoption. The first point was, as to the illegality of the existing bye-laws, and this the honorary solicitor of the Society, who was present, would certify. He could with truth say that this matter had been carefully investigated at several Council meetings, attended by larger numbers than usual. It was no doubt true that upon paper there were thirty-five members of the Council. This number included H.R.H. the Prince Consort, who was President of the Society; the Marquis of Lansdowne, and other men of high position; but he need hardly say those gentlemen were not in the habit of attending the meetings of the Council. During the whole period that he had been connected with the Council, he never remembered any subject that had been dealt with at so many and such numerously-attended meetings of that body; and it was a remarkable fact that those members of the Council who had voted upon any of the questions now under agitation had throughout been unanimous in their opinions. Therefore, in speaking in the name of his colleagues, he gave the result of the unanimous decision of those who had attended the meetings. The Council found that they were placed in circumstances of great difficulty. Their attention had been drawn to the fact that these bye-laws were in opposition to the terms of the charter, and therefore illegal. The Council, on two or three occasions, discussed that question, and came to the conclusion that these bye-laws were illegal, and in that conclusion they were fortified by the opinion of their legal adviser. The Chairman of Council, in his address at the opening of the present session, had stated generally the grounds on which the illegality rested—that, inasmuch as the charter vested the entire management of the Society in the Council, the existing bye-laws made the Board of Examiners an independent body, with power to prolong their existence when the Council and all the other officers had ceased their functions; with power to fix their own numbers; to nominate themselves, and to give to the chairman of the Board (who need not be a member of the Society) the right to attend all the meetings of the Council. He thought there could scarcely be a gentleman present who was of opinion that such laws could be maintained; and if they could not be maintained, then what was the plain duty of the Council under the circumstances in which they were placed? The proper course, if time had allowed it, would have been to call a general meeting of the members, and ask for an amendment of these laws, but there was no time for that. The occasion on which the Council met, was on the Friday previous to the second Wednesday in November. On that day the Board of Examiners had to nominate their successors. They had already put in nomination sixty-three persons whom they proposed to ballot for election, and if the Council had allowed the election of those gentlemen to have been completed, all of them would have been placed in a false position. The Council, moreover, had reason to know that an attempt was being made to create hostility between the Board of Examiners and the Council. The Board had themselves allowed that their functions had come to an end for the year, and on that ground had declined to comply with the request of the Council, to furnish them with a scheme for conducting the Examinations on the plan proposed by the Council, alleging that they were so near the end of their term of office and would not fetter the action of their successors. The Council therefore found that the only course open to them was to suspend the existence of the Board; but at the same time they distinctly expressed, by letter to each individual examiner, their intention of

renewing the Board as soon as they had received power from a general meeting, and as soon as they could do so in conformity with the terms of the charter. They therefore called this meeting together at the earliest time possible. They were surprised at the report which had gone abroad that it was their intention to *suppress* the Board of Examiners permanently, and to give up the system of Examinations. So far from their giving it up, the question had never been raised in the Council; notwithstanding this, circulars had been sent to the Institutions making the assertion that the Board of Examiners had been suppressed, and creating an agitation against the Council. In these circulars, which were signed by Mr. Brewer, who was not even a member of the Society, but a candidate for election as a member, it was stated that a meeting of the late Board of Examiners had been held, though this was not the fact, as several leading members of the Board—he knew of six —had not been invited to attend, and gentlemen who had never been appointed Examiners were invited. He confessed his great surprise that such a course had been adopted. All that the Council desired was to bring the Board of Examiners into harmony with the constitution of the Society. The Council desired to treat the Board of Examiners with every respect; they entertained the highest sense of the services they had rendered; but whilst the Council were entrusted with the management of the Society's affairs, they could not consent to an *imperium in imperio* of that description. He trusted the time would never come when the Council would submit to the dictation of any body except the general body of the members, to whom alone they were responsible. The Bye-laws which he had to propose in substitution of those now existing were as follows:—

XII.—The Examiners.

"To carry on the system of Examinations which the Society has established for the students of the Institutes in union with it, the Council shall, as soon as possible, appoint a Board of Examiners for 1858, and shall hereafter, at their first meeting after the annual general meeting in June, or as soon afterwards as may be, appoint a Board, or Boards of Examiners; and the Council shall have full power to fill up vacancies therein, and to enlarge, reduce, or otherwise vary the number of the members thereof.

"Every such board for the time being, and from time to time, shall have power to appoint one of its own members, being a member of the Society of Arts, to be chairman of such board.

"The Council may make such payments as they shall deem meet, to those Examiners who shall set the Examination questions, and pass judgment upon the answers; but no such payment shall be made to any Examiner being a member of the Council.

"Whenever it shall appear to the Council that any Examination, commenced by a Board of Examiners, cannot be properly concluded, and the awards made by that Board, before the period at which its existence would naturally be determined, viz., at the annual general meeting in June, the Council shall report the same to that meeting, and the meeting may at once re-appoint the said Board, and resolve that it shall continue in existence till its work is done, or till the new Council shall otherwise provide for the same."

The first of these bye-laws simply placed the Board of Examiners under the authority of the Council. The Council had determined, in obedience to the resolution of the last general meeting, to give up the Examination of the pupils of private shools. Schools were carried on commercially, and the Society of Arts had no means of distinguishing between the most respectable school and the veriest Dotheboys Hall. The Society of Arts must not attempt to set itself up as an educational Society or as an university. It was an Institution for the Encouragement of Arts, Manufactures, and Commerce, and it was upon that basis they desired to proceed. To set up the Society as a great university would only bring ridicule upon it. He was glad to see that there was not likely to be much response to the sentiment that had been expressed that the Society of Arts was defunct. The only basis upon which the Society could do anything was that which the charter laid down—the enouragement of Arts, Manufactures, and Commerce. There were about 350 Societies in Union with them, and they were entitled to examine the students of classes in those Institutes. The second of the proposed bye-laws would give the Board the power of nominating its own chairman, and they had inserted the proviso that the Chairman of the Board of Examiners should be a member of the Society of Arts. The next bye-law was to enable the council to remunerate the Examiners for their services. He believed that the members of the Society were hardly aware of the great extent to which the Examiners had given their services gratuitously. They had not merely undertaken the work of examination, but had met time after time and week after week. The council was of opinion that the Board of Examiners should not be an executive body—that the council and its officers should conduct the business connected with the Examinations. The work of the Examiners ought to be confined to the setting of Examination papers, and passing judgment on the answers. He hoped the meeting would not suffer their minds to be prejudiced by the memorials which had been sent up from Institutions in the country, under a misapprehension of the true state of the case. Mr. Baines, directly he found out that the Institutions over which he presided had been misled, and that the intention of the Council was not to give up the Examinations, but merely to make some alterations in the mode of carrying them on, took the earliest opportunity of setting them right; nevertheless, this misrepresentation had been circulated with great industry. Circulars had been sent to all the Institutions in connexion with the Society, leading the Institutions to believe that the Society was going to give up the Examinations. The circular which he had before alluded to, signed by Mr. Brewer, and dated King's College, London, 16th November, 1857, had been put into his hands. This circular was issued after the Council had, in the most positive manner, stated that there was no foundation for the impression that they intended to give up the Examinations. The writer was, moreover, not a member of the Society, and it seemed strange that a gentleman, in the position of a candidate for election, should issue such a circular. Without calling at all into question that it would be expedient to have oral combined with written examinations, if it were possible, the Council having most carefully considered the subject, was of opinion, and at one time in the present year the Board of Examiners was unanimously of opinion that it would be necessary to give up the oral examinations altogether. The Council, with the exception of the late chairman, had, after most careful consideration, arrived at the unanimous opinion that the oral examinations could not be carried on satisfactorily at a sufficient number of places, that it was impossible to provide against the enormous expense of carrying out that system in a manner satisfactory to the Society. It was mocking the different institutions throughout England, Scotland, Wales, and Ireland, to take their money from them, to offer to examine their students, and then to confine the examination to a few centres. The Council now invited the local authorities to take a larger share of responsibility and authority in the management of the examinations. Examinations by papers might be held anywhere. Any member of an Institution in union, however distant—however poor, however humble, his attainments—might now be made to feel the stimulus of the examinations of the Society of Arts. The local boards could examine orally, but it would be impossible to carry out that plan by Examiners sent from the Society. The meeting would gather from the programme that all those persons who, having passed a previous examination, seemed to the authorities of the local boards to possess attainments which would make it expedient for them to enter into the larger competition, would have their

names sent up to the Society; the Society would examine them, and award prizes and certificates to the most deserving. The Council heartily rejoiced in the movement at the two universities, and having no sympathy with those who decried them, had proposed to give certain assistance to persons who, by distinguishing themselves at the Society's Examinations, might give reason to hope that they would be able to obtain the new degree of "Associate in Arts."

Mr. J. GRIFFITH FRITH seconded the motion.

Mr. TOOKE, the honorary solicitor of the Society, in reply to a question, said that he had no doubt whatever as to the illegality of the Bye-laws sought to be rescinded, and had not considered it necessary to take the opinion of Counsel on the subject.

The SECRETARY then, at the desire of the meeting, read the portion of the Charter relating to the powers and duties of the Council.

Mr. BAINES said he wished to know whether the carrying of the resolution was intended to involve the approval of the whole of the plan in opposition to that already in existence.

Mr. CHESTER said that the passing of the Bye-laws would merely give to the Council for the time being the power of appointing a Board of Examiners to carry on the business, but would in no way fetter any expression of opinion on the part of the meeting in reference to the mode of conducting the Examinations.

The CHAIRMAN, in putting Mr. Chester's resolution, intimated an opinion that the bye-laws were not only illegal but absurd.

The resolution was carried unanimously.

Mr. BAINES said, that after the statement of the Society's honorary solicitor that the Bye-laws were contrary to the charter, he did not feel it right to vote in favour of maintaining them, but he conceived that that did not touch the great question relative to the distinction between the two plans of conducting the Examinations in Mechanics' Institutes. He entirely concurred in Mr. Chester's remarks relative to the exclusion of the pupils of Commercial Schools from these Examinations; they were in another category altogether from the students of Mechanics' Institutions. Although the numerous memorials presented from Yorkshire did not pronounce a distinct opinion between the two plans, yet it might naturally be concluded that they were in favour of that system of Examinations which they had seen practically at work among them. The oral part of the Examinations was a very essential feature of the system. Without the personal presence and visits of gentlemen from that Society, possessing the weight which men of science, and of public spirit in the metropolis, deservedly held throughout the country, the Examinations would not be carried on in a satisfactory manner. He believed that Mr. Chester had proposed a plan of Examination by written papers at an earlier period, but it was not found to be attractive to the members of the Institutions. On the other hand, there was a plan which had been in successful operation for two successive years, having been first tried in the metropolis only, and afterwards extended to Huddersfield. Entire satisfaction had been expressed at its working by those connected with the Examinations, except in some minor details. In Yorkshire these Examinations were felt to give the stimulus that was absolutely required to the most important part of the Mechanics' Institution, namely, class instruction. The object was to make their evening classes as successful as possible. They wanted to stimulate their young men to study. Dr. Booth had visited their various institutions; he visited them at Leeds—he proceeded to Huddersfield and Middlesborough, and personally introduced that system; and he (Mr. Baines) did not hesitate to express his conviction that if it had not been for the presence of Dr. Booth, and for the zeal and ability with which he had pushed that system of Examinations personally among the members of committees and teachers of the different Institutions, it never would have come to anything in the North. He should be acting most unjustly to a public man if he did not state that as far as he could possibly judge they were indebted for the actual existence of the plan in operation in the north of England entirely to the exertions of Dr. Booth. He believed it was only by the personal presence of some of the Council amongst them that much could be done; he did not mean to say that without their presence success could not be attained; but the system would be immensely more likely to succeed if the Society sent down Examiners for the purpose of conducting Examinations among them. They would be much more certain of fairness and impartiality if Examiners were sent down from London to conduct the Examinations. There was an undoubted advantage in oral Examinations over Examinations by written questions, in getting at the real attainment of persons under Examination. If there was any case in which written Examinations were not quite satisfactory, this applied to Mechanics' Institutions, many of the members of which, while they possessed high mathematical and mechanical attainments, would be unfairly treated if judged by the answers which they might set down upon paper. He might mention the case of the teacher of the Huddersfield Mathematical Class, who was a plasterer, but who had attainments of so high a character that he successfully conducted a mathematical class, and infused into others that enthusiasm which he himself experienced. He believed that it would do the greatest possible injury to depart from the plan of oral examination, and he therefore proposed the following resolution:—"That, in the opinion of the meeting, it was desirable to continue the present system of Examination, including Oral Examination, by Examiners of the Society of Arts."

Mr. WATTS seconded the motion.

Mr. J. G. CRACE said he considered that education ought to be encouraged, but that there ought to be proper societies to do it. It should not be the Society of Arts, Manufactures, and Commerce that should stand alone in matters of that description. Their funds, their time, their energies, ought to be more worthily exercised in advancing the great objects of their charter.

Mr. THOS. WEBSTER, F.R.S., said, he looked upon the educational movement, or this system of Examination, which the Council had established, as one of those great steps of progress that the Society had been so eminent in carrying forward. He trusted, however, that the Council would not allow themselves to be diverted from the legitimate objects of the Society, and indeed he had no fear upon that point. At their weekly meetings, discussions had taken place upon what were most legitimate objects—Arts, Manufactures, and Commerce. No one would venture to assert that the legitimate objects of the Society had been sacrificed. He thought that no one who had had any experience in education—no one who passed through the universities, who knew how the men there were trained for Examination on paper—no one who knew the character of the men who were to be examined in connection with the Institutions—no one who knew the success of that great educational experiment that was being carried on under the Committee of Council, could doubt that oral Examination was the most valuable adjunct they could possibly have. If practicable, oral Examination ought to be carried out. If Dr. Booth, Mr. Baines, and others, told them it was practicable, he could not but hope that some means might be adopted to give a fair trial to the system.

The Rev. RICHARD WHITTINGTON said, he was the honorary secretary of the Crosby Hall Evening Classes. He most cordially agreed with Mr. Baines in almost everything that gentleman had said, and was most anxious to see the system of oral Examination carried into effect. He agreed with Mr. Baines as to the necessity of having some of the Examiners of the Society present at the Examinations. Without this there never

would be a guarantee for the honesty of the Examination. The certificate would not be half so valuable unless the Examiners were present.

Mr. Varley, after an experience of forty years, felt bound to agree with Mr. Baines's proposition. Many a man who could hardly write had materials within him which would very soon show themselves in oral examinations.

Mr. William Hawes said that no one could doubt the truth of the statement that had been made by Mr. Baines, but the question was not the abstract one of what was the best mode of promoting the education of mechanics, but what means were within the reach of the Society to promote that education to the utmost extent. Several statements had been made with reference to which he believed a considerable amount of inaccuracy existed. If they looked at the Universities, they found at one a system of oral, and at another a system of written Examination, but the new system, of which Oxford had already published the programme, was confined exclusively to written Examination for those above 15 years of age. They had been told that the presence of the Examiners from London, was essentially necessary to secure the fairness of the Examination. The question was, were they to limit the number to be benefited by the Examinations, to those who could afford to travel to a few places only. He thought the usefulness of the Society would be limited by oral Examinations, which required such a large number of Examiners. It they took the more extended and better system they would have the whole of the candidates tested by one body of men, and a uniformity of certificate which would give a fixed value to the operations of the Society. The Council were anxious that the meeting should thoroughly and decidedly express their opinion upon the subject, because it was one upon which the utility of the Society materially depended. The cost of one centre in London, and one in the country, last year, the Examiners giving their time gratuitously, was so great, that if they multiplied it by eight or ten, the income of the Society would be almost swallowed up. It was not for the societies in the country to call upon them to spend the whole of the funds of the Society upon this one object. He hoped the meeting would leave the decision in the hands of a number of gentlemen who had hitherto conducted the business of the Society with great success. Let them carefully consider the subject, and rely upon the Council for the proper management of the business of the Society. He trusted that they would not, by adopting Mr. Baines's resolution, cast a stigma upon the Council.

Mr. Bentley Shaw said he was of opinion that the Institutes owed a debt of gratitude to the Society for the benefits they had received from it. He had joined the Society in order that the Mechanics' Institution near Huddersfield might be connected with it. He entirely agreed with Mr. Baines with respect to the benefits resulting from oral examinations, and he trusted, for the sake of the working men that this plan would be carried out. The very best possible mode of promoting Arts, Commerce and Manufactures, was by educating the working classes to the greatest possible degree.

Mr. Thos. Scott moved the following amendment: "That the Council of this Society be instructed not to expend any of the Society of Arts' funds in education, unless specially granted for that purpose."

Mr. J. G. Crace seconded the amendment.

The Chairman ruled that, as the amendment was in direct contradiction to the Bye-laws which had just been passed, it could not be put.

Mr. Josiah Wilkinson said, the simple question was, whether oral or written examination could be conducted with the greatest advantage to the Society. He could not concur, to the full extent of his motion, with Mr. Baines. He thought they would be acting unwisely if they in any way attempted to fetter the Council in the measures which they thought it right to adopt, although he was struck with the observations of Mr. Baines, relative to the fear of partiality in local examinations, as well as to the imperfection attending written examinations; still he thought that if they adopted oral examinations with a limited number of centres they would do injustice to all the Institutions at a distance from these centres. There were 14 different subjects of examination proposed; conceive the difficulty of sending down qualified men to examine on 14 different subjects, at half-a-dozen centres. They had no right at present to sanction such an expenditure as that which had been contemplated. He proposed to invite the meeting to leave the hands of the Council entirely unfettered, and therefore would offer, as an amendment, "That this meeting, while it recognizes the value of oral Examinations, continues to have entire confidence in the Council of the Society, and entrusts to it the working out of the question of Examination among the Institutions in Union."

Mr. J. McGregor seconded the amendment.

Mr. Hyde Clarke said—Concurring as he did, to the fullest extent, in the great value of oral examination, he yet felt that the Council would be placed in a difficult position if Mr. Baines pressed upon the meeting the motion he had proposed. There was nothing in the motion itself from which from which he could dissent, but he thought a motion of that kind would tend to embarrass the Council of the Society, and even the Mechanics' Institutions themselves; because, although the mover of the resolution came there as the representative of a large union of Mechanics' Institutions, yet they had evidence in the memorials themselves that there was difference of opinion amongst those Institutions. Then as to the cause of education itself, he was in doubt whether they would not inflict a serious injury upon it by adopting oral in preference to written examinations; for, whatever might be the abstract superiority of the former, it was evident from what they had heard that the system of oral examination could touch only about 400 candidates, but under the written plan they might examine much greater numbers. He feared that in supporting this motion they would be injuring the cause of education; he therefore hoped the mover of the resolution, having succeeded in obtaining some expression of feeling in favour of oral examination, would not insist on putting the Society in a position of difficulty, but would withdraw his motion.

Mr. Samuel Morley said the resolution of Mr. Baines only went to the extent of expressing a wish to continue the system as it had hitherto been carried out. From the speech of Mr. Hawes he gathered that Mr. Baines's resolution was regarded as a wish to change the course already adopted. If so there was a great misconception of Mr. Baines's meaning. That gentleman had brought with him evidence that the Mechanics' Institutions of Yorkshire were in favour of oral examination. He had given reasons in favour of that system, and it was a serious thing to speak of Mr. Baines's resolution as a stigma upon the Council. He (Mr. Morley) did not understand it as such. Mr. Baines had merely advocated the existing system. He had shown that, although scarcely begun, it had worked admirably. There were certainly imperfections in it, but it excited interest in the cause of education. He contended that Mr. Baines was not entitled to be spoken of as reflecting upon the Council, or wishing to obtain the assent of the meeting to a merely abstract proposition. Then with reference to education itself, if they determined that this Society should have nothing to do with education, it would become the dead thing it was twenty-five years ago. He spoke in the interests of trade when he asked them to stand by education and largely extend their operations in that direction. It was not enough that the scientific subjects of the age should be discussed as they were in the most able manner, at their weekly meetings. In

these days of progress and effort it was a glorious thing to combine these with the furtherance of the cause of education. He endorsed the views expressed as to the value of personal communication with the Institutions throughout the country, and he could not but express his admiration of the course which Dr. Booth had adopted. He had read too many of the addresses of that gentleman not to express the admiration he felt at the energy he had shown in the cause of education. He particularly referred to the late address of Dr. Booth before the Mechanics' Institution of Manchester. In conclusion he begged the Council to pause before they altered a system which had hitherto worked so well.

Mr. G. F. WILSON, F.R.S., said, having strong feelings in favour of oral Examination, and being connected as President, with two Mechanics' Institutions numbering 600 members, he would, in a few words, state why, as a member of the Council, he had adopted the views of his colleagues in favour of written Examinations. They had the experience of the last year; a very important experiment was then tried. It was not without some difficulty that competent Examiners could be obtained, sufficient for the number of centres then proposed. The Council, carefully considering the matter as men of business, came to the conclusion that they could not extend the system of oral Examination in a way to give real results. They might see it noticed in the newspapers that the Society held Examinations in a great many places, but the results could not have been real. The meeting could not fail to be struck with the remark of Mr. Baines, that even in the very stronghold of Mechanics' Institutions, with all his personal influence there, it required all the efforts of the Society thoroughly to organise the Examinations in that local centre.

Dr. CARPENTER, F.R.S., said, having acted as an Examiner, and having taken a deep interest in the system ever since its commencement, and having had nine years' experience as an Examiner in the University of London, he thought he could make one or two remarks upon the subject which might help the meeting in coming to a conclusion upon it. With regard to oral examinations superadded to written, his own experience and that of a great many other Examiners had been this—with reference to educated young men, the great value of oral examination was in checking cramming. Dr. Carpenter then referred to some instances coming under his own observation, to illustrate this view. He (Dr. Carpenter) was on one occasion in danger of rejecting a very deserving candidate who failed in written examination merely from slowness and for want of power to put upon paper knowledge which upon oral examination he was found to possess. He had a very strong conviction that for any perfect system of examination oral in addition to written was an essential element. He, however, appreciated the difficulties in which the Council of the Society found themselves placed; he entered also into the financial difficulties of the question, and the issue seemed to be this:—The Council, if they thought it best for the interests of education, would be prepared to carry out the system of examination upon its first footing, that was, one, in London and one in some other centre, at which oral examinations should be conducted, but he could understand the difficulty of extending the system beyond these two or three centres, and he could enter into the wish of the Council to extend the benefits of the examinations as widely as possible, by giving the opportunity to a large number of Institutions to take a share in them. The question then was this—Was it best for the interests of education, the interests of the Society, and the interests of the Institutions, to have what he must characterise as an inferior and imperfect examination carried on extensively, and to give certificates upon an imperfect system, which would not have the value which the certificates upon a better system would have. What he thought best was to confine the examinations to two or three centres, capable of extension as the funds allowed, but carried out upon the best possible principle. He could not conceive that any censure would be cast upon the Council by the adoption of either of these two plans. For his part, he was strongly in favour of keeping the Examinations at a high standard, and making them to be felt an honour and a credit. However, he was for leaving this question to the decision of the Council, as they were the persons who were constantly in communication with the various Institutions throughout the country, and were always ready to act in accordance with their views. He believed the Council were best fitted to carry out the objects of the Society, and he should give his support to the amendment which had just been proposed.

Mr. CHESTER did not agree with the gentleman who had said that the carrying of Mr. Baines's resolution would cast a stigma upon the Council. He believed there was no such intention. At the same time, if the resolution were carried, the Council would feel it as a withdrawal of the confidence of the Society. The Council would pay all due deference to the decision of the meeting, but they would regard that resolution, if passed, as a withdrawal of confidence in them. He was not for a moment prepared to contend that after what had passed the Council might not reconsider the subject, but he should mislead the meeting if he held out the hope that the present Council would be able to carry out a system of oral examination by the Society's own Examiners. This subject had been discussed at three meetings of the Council, to the exclusion of any other matter, and after the most careful and painful deliberation, they came to the conclusion, 12 to 1, that it was impossible to carry out the oral examinations. Mr. Chester then referred to the minutes of a resolution passed in February by the Board of Examiners. There were twelve Examiners present, and they passed an unanimous resolution, moved by himself and seconded by Dr. Booth, to give up oral examinations after the year 1857. He did not contend that it would not be desirable to combine the oral with the written, if possible; but he was certain, if this meeting could constitute itself a Council to discuss the ways and means, they would come to the conclusion at which the Council had arrived. A great deal had been said as to the impossibility of carrying on these oral Examinations by the Society in a great number of different places. He was prepared to say they could not carry them on in London alone. If the system succeeded, they would have such an immense number of candidates from London alone, that it would be impossible to conduct the Examination of so large a number orally, considering the time necessary to do justice to each candidate. The friends of education, of whom he was one, must see that there was a feeling among some members of the Society against these Examinations altogether. The Council had given the subject their fullest consideration, and they were of opinion that they could do perfect justice to all the other important objects of the Society, if the programme they had issued were carried out, but they could not do so if the members insisted upon oral Examinations. A part of their plan was, that Examinations should be held previously in the different localities, and in all those localities the Examinations might be conducted orally if it was thought necessary. It pained him very much to hear Mr. Baines—the champion of local authority in education and of the voluntary system—tell them that they could not trust the local bodies to carry out these Examinations. If they could not trust them, then let them give the whole thing up. If the oral system were attempted, it would be impossible for the Society to carry on the Examinations, and the whole scheme would be handed over to the Government. Then the plan which had been before them for the last ten years, in Dr. Booth's celebrated pamphlet, would be realised, and we should indeed see "Examination the Province of the State." What they all desired to see was the development of local authority in education; they wished

to see local boards rise in importance. He hoped that out of all this some agency would arise which would take the place of the Society of Arts. The Society would show what ought to be done, and how it was to be done; and ultimately it was to be hoped that the local authorities would develope something exactly suited to their wants.

The Rev. Dr. BOOTH, F.R.S., merely rose to call attention to some of the regulations which were laid down last year for conducting the Examinations. In those regulations he held that the entire system of local boards and local management was recognised as put forward in the programme just issued by the Council. Should he tell them his own experience of how that worked? They had only one board in all England that was able to comply with the regulations sent down, and that was at Wakefield. So far from those regulations being carried out, the Secretary knew that they had to violate their own conditions, and admit candidates to Examination from Institutions where there were no classes for instruction and no local Boards for previous examination. They had constantly to violate their own regulations until at last they became absolutely a dead letter.

Mr. HENRY COLE, C.B., was in favour of oral Examinations where they could be carried out, and he believed a combination of oral and written was the best system if practicable. With reference to what Mr. Baines had stated, did that gentleman believe that it was impossible, with such men as himself and Dr. Hook, and Mr. Beckett Denison, to establish local boards for Examinations? He would ask Mr. Baines whether he was honestly of opinion that he could not get an impartial Board of Examiners in Leeds. He (Mr. Cole) was of Mr. Baines' opinion with regard to oral Examinations, but if they could only have one Examination in London and one in Yorkshire, they deprived the other Institutions of that advantage, and candidates could not be Examined unless they travelled to Huddersfield or London. This would not be doing justice to the other Institutions throughout the country. The Council wished to carry out the system of Examination which would be the most generally available, but if the meeting persisted in voting for oral Examinations, it was tantamount to saying that the Council did not know how to conduct the business which they had so fully discussed. They had before them the instance of the Examinations at Huddersfield last year. The Council, then, had difficulty in getting Examiners to go there. To have attempted to carry them out in another centre simultaneously, would have been absolutely impossible; and even the Board of Examiners had discussed this subject, and come to a resolution in favour of paper Examinations. He thought it was possible to do something in the way of oral Examinations, but if he were asked whether it could be extended to the 350 Institutions in union, he should decidedly say it was impossible. Let them try to do the best they could for those Institutions, but they should pause before they rushed into a system which, upon the face of it, was impracticable for all.

Mr. BAINES might, with the same good humour with which Mr. Chester had twitted him with regard to the voluntary system, turn the argument against that gentleman himself, and ask how it was that he, as a State educationist, sent persons from Downing-street all over the country, whilst, at the same time, he argued in favour of local authority, without aid from the metropolis. Mr. Cole had asked whether he (Mr. Baines) could not form a board of Examiners in Leeds? He would not say it was impossible; but candidates who were disappointed in their hopes would not be satisfied that the Examination had been as fairly and openly conducted, free from all local and even innocent partiality, as if gentlemen were sent down from London to conduct the Examinations. Mr. Chester appeared to regard it as a crime to ask poor young men to go to a distance to be examined. In Leeds there were a number of young men who stood a fair chance of successful examination; the Institution paid their expenses, and Bradford did the same, and candidates were sent to London and to Huddersfield; therefore the objection of Mr. Chester on that ground was not valid. They might increase their centres, and yet not make them so very numerous as some appeared to apprehend. Last year they had one local centre; this year they had two. It had been proposed next year to have five, and his belief was, that they would have found those five so successful that they would have rejoiced in after years to extend them to ten and twenty. He knew they might state difficulties in the way of anything. He stated difficulties when Mr. Chester brought forward his plan for the union of Mechanics' Institutions with the Society of Arts, and he very well remembered the answer of Mr. Chester, "We know there are difficulties, but we know how to cope with them, and we will overcome them." In like manner they could overcome the difficulties connected with these Examinations. He was not advocating innovation, but only the gradual extension of the system already adopted. They had gone to Lord Palmerston and the Right Hon. Mr. Cowper, and had asked them to leave the examination of Institutions in the hands of the Society, pledging themselves to carry on such Examinations. It was said by Mr. Chester, with a degree of confidence that startled him, that they could not examine orally even those who presented themselves in London. He would not set up his opinion against that of Mr. Chester, but he would set up the opinion of a body of gentlemen who he thought ranked still higher as authorities on this particular question than even Mr. Chester himself, namely, the Board of Examiners. Mr. Chester had quoted a resolution passed by the Board in February last. He (Mr. Baines) would quote a resolution passed by the same body in October last. The resolution stated that the Board believed it to be desirable to secure the confidence of the public in the integrity of their decisions, that every central examination should be superintended by two or more members of the Board. The great expenses of the last examination had been mentioned, and it was argued that if the centres were multiplied the expenses would be multiplied in the same proportion. He submitted that that would not be so. There were expenses of printing, &c., which attached to the Examinations, which would not be perceptibly increased. The travelling expenses would be increased, but after all the Society had done, were they to be baffled by being told that it would require a few hundreds more to carry out a system of Examination in which every one had confidence, and which was immeasurably superior to the system of mere written papers? He had come prepared to hear difference of opinion upon the subject of oral examinations, but there was very little. He would say to Mr. Hawes, who used the expression that if his (Mr. Baines) resolution were carried, it would be a stigma upon the Council, that nothing was further from his intention than to cast any stigma upon that body. They were called together to discuss a question of vital interest, namely, the Examinations, which was a matter entirely apart from personal considerations. He had one further remark to make. From the knowledge he had of the Institutions in the country, he was bound to tell the meeting that if they came to a decision opposed to the spirit of the resolution he had submitted, that decision would create grievous disappointment. It would be regarded as a complete change in their system. This was the one grand point in question. It was on this they were called upon to express their opinion, and he hoped the decision would be one that would tend to promote still further the connection of the Mechanics' Institutions of England with this great and important Society.

The CHAIRMAN then read the original motion, and also the amendment. On the amendment being put from the chair, it was carried by a very large majority.

Mr. E. B. DENISON then submitted a motion to the effect that the expenses incurred by Dr. Booth in the printing of a pamphlet issued by him in his own defence should be defrayed out of the funds of the Society. He submitted this motion without any previous communication with Dr. Booth, and wholly without that gentleman's cognizance, and was prompted to do so because the pages of the Society's *Journal* had been closed against Dr. Booth, unless he consented to submit his statement for the approval of the Council, which he could hardly be expected to do.

Dr. BOOTH extremely regretted that such a proposition had been made, and he begged Mr. Denison at once to withdraw it, as he had already paid the expenses of printing his pamphlet.

The proposition was withdrawn.

Mr. TOOKE proposed a vote of thanks to Mr. Bodkin for the very admirable manner in which he had presided over the business of the meeting, which was seconded by Mr. Dilke, and carried by acclamation.

The CHAIRMAN returned thanks, expressing his gratification at the amicable spirit which had characterised the meeting.

THIRD ORDINARY MEETING.

WEDNESDAY, DEC. 2, 1857.

The Third Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 2nd inst., George Lowe, Esq., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Abbott, Edwin Morton	Hastings, George Woodyatt
Adams, James, jun.	Hawkes, Rev. H.
Bicknell, Algernon, S.	Hooper, William
Botterill, John	Jackson, Edwin Ward
Brooks, Maurice	Jenkyns, Ivan Charles
Browell, Edward M.	Kendall, Rev. J. H. F.
Brown, Chas. Blakely, M.D.	Kitson, James
Brown, John	Leary, George David
Browne, Rev. Prof. Robert	Levy, William Hanks
Catt, Henry	Manning, John
Charlesworth, John C. D., M.P.	Mewburn, Francis, jun.
	Peover, George
Clegg, Thomas	Ranger, William
Colquhoun, John Campbell	Reeve, Charles
Coulton, Isaac Love	Roberts, James
Cressingham, Jonah	Roupell, William, M.P.
Davies, Evan, M.A.	Rumball, Thomas
Garraway, George	Rumney, Robert
Grassett, Elliott	Sandeman, Thomas G.
Hall, William Bancks	Seale, Sir H. P., Bart.
Hamilton, Archibald	Shout, Thomas Hammond
Hamilton, William, R.N.	Vaughan, Edward P. H.
Hardy, T. Duffus	Wood, John
Harris, Alfred, jun.	Woolley, Thomas
Harris, George	Young, David Alexander

The following Colonial Institution has been taken into Union since the last announcement:—

Swan River Mechanics' Institution, Western Australia.

Previous to the reading of the Paper, the Secretary called attention to some specimens of double and triple salts of Ammonia, Magnesia, Soda, and Potassa, which had been placed in his hands by Sir James Murray. A description of these will be found in the present number of the *Journal*, at page 47.

The CHAIRMAN complimented the author of the paper about to be read, as having for many years devoted his energies to work out that '*vexata quæstio*,' the comparative heating powers of coal and coke. He was happy to see around him many who had signalised themselves in this matter of producing the most heat and the least smoke. He would only add that he trusted the discussion of Mr. Pellatt's paper might partake of a practical rather than a scientific character, as, doubtless, one pound of bituminous coal, having all its hydro-carbon saturated with oxygen, must give more heat than the same weight of coke or anthracite, but the facts of daily practice were wanted.

The Paper read was:—

ON THE COMPARATIVE HEATING PROPERTIES OF COKE AND COAL IN REGARD TO ECONOMY AND THE PREVENTION OF SMOKE.

BY APSLEY PELLATT.

The coal fields of Great Britain may be considered as the substratum of our commercial wealth, but for this munificent gift of Providence, our manufacturing steam-powers could only, in a limited degree, be maintained.

The abundance of this almost inexhaustible supply of fuel enables us to propel our locomotives, floating batteries, steam mercantile marine, and millions of spinning jennies, mules, &c., in our textile workshops, affording also the means of fusing minerals, metals, &c., and of bringing formerly useless residuum into valuable chemical products.

To enable us commercially to compete with foreign rivals, we should not simply rely upon our abundance of coal and the improved modes of ventilating and working our mines; we should also consider the heating powers of coke as compared with coal, in order to ascertain which is the most effective fuel in reference to economy and reduction of smoke. These are points well worthy of our practical deliberation.

The most striking example of apparent indisposition to reduce the smoke nuisance has been recently exhibited at Manchester, by the dense volumes of smoke almost constantly issuing from her countless tall manufactory chimnies, which so excited the attention and astonishment of strangers on their recent visit to the great Exhibition of Art Treasures. Any person ascending one of those immense manufactories, in expectation of getting a bird's-eye view of the city, would only behold a dense murky floating vapour of smoke. Sheffield, Leeds, Birmingham, Newcastle, and most of the great Northern towns, rival Manchester in impurity of atmosphere and, probably, in wasteful consumption of coals. The southern and eastern localities of the metropolis were worse, in that respect, than the cities of the north, until, by the stringent operation of Lord Palmerston's Smoke Act, metropolitan manufacturers were forced to use coke and other smokeless fuel, or to adopt some smoke preventing apparatus. Any person standing upon either of the bridges of Blackfriars, Waterloo, or Charing Cross, on a fine day, looking up or down the River Thames as far as the naked eye can carry, will notice a much clearer atmosphere than formerly, a convincing proof that owners of steam vessels above bridge, and proprietors of metropolitan manufactories, mills, and breweries, on both sides of the river, by complying with the requirements of the Smoke Act, have succeeded in freeing that part of the metropolis from smoke to a greater extent than most manufacturing towns or cities in England.

It is true that Lambeth (and its potteries) is still a nuisance, greatly complained of by the South-Western Railroad travellers and others, and will, in a great measure, remain so, until the New Smoke Act of 19 and 20 Victoria shall be brought into operation, viz., on the 1st of January next, 1858. Several years prior to the passing of the Smoke Act of 1853, a commission, at the recommendation of the House of Commons, was appointed, consisting of the late Sir Henry de la Beche, and Dr.

Isaac Lyon Playfair, who, having visited the manufacturing districts, reported that in the event of smoke legislation taking place, potteries and manufactories of glass and iron should be exempted from the Act, until the further progress of practical science would allow of their being placed under the same category as all other factories; that period it is considered has now arrived, therefore, under the provisions of the new Act, all smoke-making manufactures must soon comply with its requirements or submit to its penalties. Messrs. Doulton and Sons, the eminent potters of Lambeth, are in advance of most of their neighbours, having erected several kilns on an improved construction, for bringing the bituminous, as well as the carbonaceous constituents of coals into combustion within the furnace, allowing only the comparatively transparent light vapours to escape through the chimnies or cones, and no new factories are allowed by the Government to be erected in that locality unless they are comparatively smokeless, it therefore behoves smoke-making potters to be on the alert in immediately effecting their improvements.

[Mr. Pellatt described the arrangement and action of a smoke-consumiug furnace for Potteries, invented by Mr. Doulton. A description of this will be found in the Society's *Journal*, vol. 4, p. 601.]

Some potters have mixed with their coals a large proportion of gas coke, which not only economises fuel, but reduces smoke; other manufacturers have also used a large proportion of gas coke advantageously. Messrs. Williams, Parkes, and other writers, led the attention of the manufacturing public to the heating powers of coke many years since, and one of the intentions of this paper is to revive this interesting subject, and to explain its advantages by practical remarks and quotations from scientific authors, in the detail of experiments which have proved the economy of using gas coke partially or wholly, instead of coals, in localities where it may be purchased comparatively cheap. Mr. Wye Williams, of Liverpool, who published as far back as 1840, has recently received a prize from the Society of Arts for his practical and scientific essay " On the Smoke Nuisance."

Mr. Joseph Parkes, about the year 1850, read several papers before the Institution of Civil Engineers, detailing experiments he had made on the relative calorific power of coal and coke for evaporating water.

I also read a paper on the same subject before that Society, giving an account of experiments I had made with coke for melting glass, which confirmed Mr. Parkes' results, viz., that one chaldron of coke, weighing 13 or 14 cwt., performed the same heating duty as one ton, or twenty cwt. of Newcastle small coals. The coke used for these experiments was oven burnt (somewhat stronger than gas coke), made of small Newcastle coals. More recent experiments upon gas coke in lieu of oven burnt coke have, however, scarcely altered the practical results.

The above operation of fusing glass with coke fuel was continued for several months, the consumption of coke was at the rate of about thirty chaldrons per week, and the coal about the same number of tons. Mr. Frederick Pellatt, at the Falcon Glass Works, Southwark, has recently used gas coke fuel in the proportion of twenty chaldrons of coke to one ton of coals, for above twelve months, with economy and success, and has fully corroborated previous experiments; he has also experienced collateral advantages, viz., that coke refines the metal many hours earlier than coals, is more certain in its effects, especially under unfavourable winds, that the pots or crucibles are of longer duration, with a relative saving of about $2\frac{1}{2}$ per cent., and an almost entire prevention of smoke. It may be assumed, therefore, that in localities where gas coke can be purchased as cheap or cheaper by the chaldron than small coals can be by the ton, coke will be superior to coal in heating power for raising steam or for melting metal. Gas coke made from Wigan coal is of fair quality, although not so good as that from Newcastle coal, and may be had cheap at the Liverpool, Manchester, and other gas works. Coke made from Barnsley coal is decidedly inferior, and from boghead or cannel coal scarcely better than breeze. Coke carted from the retorts freshly made is better than that which is taken out of store. Coke, if stored, should be placed under cover, and kept free from wet. Coke carted direct from the gas works for immediate consumption is much more valuable than when broken by storing or lightering, or, by being repeatedly moved, which reduces a considerable portion of the coke to breeze; the latter fills up the interstices of the coke, and impedes the draft of air or oxygen, so essential to its speedy ignition and calorific effects. Messrs. Maudslay used gas coke in air furnaces for fusing brass, but are now burning Welsh coals. A large quantity of gas coke is used in the proportion of one-third of coke to two-thirds of small coal, with great economy, and almost smokeless effect, at the extensive works belonging to the Lambeth and Southwark Water Company at Hampton, under the able superintendence of Mr. Quick, their engineer.

It seems somewhat anomalous that Newcastle or other bituminous coal, after having parted with the whole of its bituminous constituents by the process of coking, and that to the extent of one-third of its weight, should, by the combustion of the carbon or coke only, give as much calorific effect as coal with its combined powers of bitumen and carbon, whether for raising steam or for fusing metals, which not only the before-mentioned facts go to establish, but which has been lately again confirmed by the use of coke under a ten horse boiler at the Falcon Glass Works, which superseded the previous use of coal, although they were aided by Knowelden's patent machinery for spreading equal quantities of small coals in uniform supply over the surface of the furnace, kept in motion by alternate moveable bars between fixed bars, connected by a crank with the engine power, producing a sort of rotary diaphram action, or onward impelling movement, which, with a proper admission of air, effectually prevented smoke. For some time it worked extremely well, but as coke at that time was 10s. 6d. per chaldron, while the price of small coal was 13s. per ton, it was discontinued. This invention has been recently tried by the French Government, and was reported upon in the *Times* of the 5th August last, under the head of Paris, to the effect that Knowelden's patent for France had been purchased by the municipal authorities of Paris, after a trial of fire place and bars, imported into France specially for the experiment. It has been decided upon as the cheapest in application, as well as for the economy of fuel, and unattended by the danger of explosion (as was the case with the invention which Mr. Knoweldens' patent superseded), as also for completely preventing smoke. Most of the brewers of the metropolis are now great consumers of screened small coal, upon Juckes's old established endless chain principle, with economy and success, which also effectually prevents smoke.

No doubt many other good inventions, such as double furnace boilers, &c., are in use in England, but, I think, these remarks are due to Mr. Knowelden's patent, the writer having watched its operation for several months.

Mr. Williams, of Liverpool, considers the apparent anomaly before referred to, viz., carbon or coke only, doing duty as effectually as coal with its double constituents of bitumen and carbon in a compact state of adhesion, is due to, or explained by, the " expansion and fusion of the bitumen, the generation of the gas, its absorption of heat during such expansion, its combustion, the subsequent combustion of the solid carbon, and so on; for, if not managed with due attention to the wants of each, these several processes interfere with, and mar each others effect; also, that if a charge of fresh coal be thrown on a furnace already in an active state, so far from augmenting the general temperature, or giving out heat, becomes at once an absorbent of it, and that so long as any of the bituminous constituents remain to be evolved from any

atom, or division of the coal, its solid, or carbonaceous part remains black, at a comparatively low temperature, and utterly inoperative as a heating body." He further compares such loss in the process "to the consumption of fuel under retorts during the process of gas making, the entire accessible heat being absorbed and carried off by the bitumen during its expansion," and the release or evaporation of the ammonia, water, &c. Thus he solves, in a great measure, the apparent anomaly of bituminous coal giving out no more heat than is due to the combustion of its coke only.

As the value of tar, ammonia, sulphur, naphtha, and the bituminous products of coal get more commercially known, other means of separating coke from coal may probably be devised, and the waste of valuable bituminous products prevented, thus throwing into the market much greater quantities of coke than can be produced at gas works for furnace combustion.

For private use, gas coke is objected to on account of a disagreeable sulphurous smell, which, at the gas works at Liverpool, is obviated, by putting about 14lbs. of common salt to every charge of coals in the retorts, which, when distilled with the coal, is said to purify the coke, and improve the quality of the gas. A prejudice exists that coke used for fuel under steam boilers is destructive to the bottom plates. With an enlargement of fire-place for incandescent coke, while operating upon an enlarged surface of the under boiler plates, no material deterioration takes place. Mr. Innes, engineer to the Phœnix Gas Works, at Bankside, had a boiler for nine years working day and night with gas coke, after it had been used with coal in other works for seven years, making a service on the whole of sixteen years. Its form was cylindrical, 16 feet long by 3 feet diameter, with a furnace 5 feet long by 2 feet wide.

The abolition of the smoke nuisance in Manchester and other northern cities would cease to darken and discolour its churches, commercial palaces, and handsome public edifices, to say nothing of injury to curtains and furniture; Victoria-park, and the vegetation and foliage of the shrubs in the environs of great cities would be much improved.

If the gardener of the templars, on the Thames, sang the praises of the Smoke Nuisance Prevention Act, for restoring the beauty of his roses, foliage, &c., should not such benefits be extended by the same means to the smoky Peel-park of Salford, and to the manufacturing districts of the north? Shall it be said that their merchant princes are indifferent to the advantages of a purer atmosphere for the cleanliness and comfort of the working population, who have already so nobly expended millions of money in people's parks, public libraries, literary institutions, churches, chapels, &c.? Shall these manufacturers be driven into improvement by the extension of the Metropolitan Act to all the provinces, with the Home-office police to enforce its provisions?

If the Royal Commissioners appointed to determine whether the site of the National Gallery should be changed, acknowledged "that in regard to atmospheric impurities, recent legislation, which had done *so much*, and may do more to purify the metropolitan atmosphere, would probably much improve its present condition," and who reported that its present site was most advantageous, shall it be said of the magnates of Manchester, whose city recently received so powerful a stimulant in the fine arts by its magnificent Exhibition of Art Treasures, that they have no sympathies in favour of purer air and the reduction of the smoke nuisance? Is it to be said, in the words of the poet, that it is not to

———— "be preferred to smoke,
To the Eclipse that metropolitan volcanoes make,
Whose Stygian throats breathed darkness all day long."

Surely the time has arrived when humanity, art, science, and philanthropy, should combine to prevent the air in all our manufacturing districts from being longer contaminated with volatile, bituminous, discolouring impurities, which in most cases might be turned into profitable channels of commercial remuneration, and thus improve the health and wealth of the British nation.

DISCUSSION.

Mr. Charles Wye Williams said, although the author of the paper had done him the honour to quote somewhat extensively from the works which he had laid before the public on this subject, he nevertheless differed entirely from that gentleman's conclusions on several important points. Mr. Pellatt had said it was somewhat anomalous that Newcastle or other bituminous coal, after having parted with the whole of its bituminous constituents by coking, to the extent of one-third of its weight, should give as much calorific effect as coal with the combined power of bitumen and carbon. Now if the fact were so, it would be an anomaly, but it was not the fact that coke possessed superior or even equal heating properties with coal. The author of the paper had stated that he (Mr. Williams) explained away this alleged anomaly by showing the great heat that was lost in the generation of the gases. It was true he had dwelt upon the loss of heat in the generation of gas, but he did so to show that unless they turned those gases to account, they lost all the heat that was absorbed in generating them. From these and other circumstances, he thought the author had not seen the second edition of his treatise, inasmuch as on several points there was an evident misapprehension of his (Mr. Williams's) views on this subject. He had found that even the most scientific men had been often led into great errors on this question, instancing the case of Dr. Fyfe, of Edinburgh, who had expended much laborious research in order to prove that the value of coal was only in proportion to the quantity of fixed carbon that it contained. Never was there a more erroneous idea. The author of the paper had stated that Lord Palmerston's Act compelled the use of coke instead of coal.

Mr. Apsley Pellatt begged to say the Act did not compel the use of coke, but only that there should be no smoke from the chimnies of manufactories, leaving the parties to employ what means they chose to prevent the smoke.

Mr. Williams added that in Liverpool the prosecutions under the Smoke Act were very frequent, and they were obliged to use coke or anthracite coal; they could not burn common coal in their furnaces, simply because they did not admit a sufficient quantity of air into them. A recent instance of the mistakes into which engineers sometimes fell, was afforded in the case of the boilers of the *Leviathan*. He must say they presented the greatest violations of natural and chemical laws that he had ever witnessed. He defied them to burn coal in the furnaces without great waste of fuel and enormous evolution of smoke, and they must use anthracite coal. The same remark applied to the *Great Britain* steam-ship, Each double boiler of the *Leviathan* contained 12 furnaces, and about 400,000 cubic feet of atmospheric air per hour was required for proper combustion of the gases alone; but how was the air to get into the furnaces? It really seemed as if the utmost pains had been taken to exclude the air; and to say that the air could be supplied through the fuel on the grate, was to say that a man could breathe the air which came from the lungs of another person. It was an ascertained chemical fact, that a ton of coals producing 10,000 cubic feet of gas required 100,000 cubic feet of air for thorough combustion. Prof. Daniel had even estimated it at double that quantity. Mr. Williams produced for the inspection of the meeting an apparatus for indicating the quantity of air that passed into a furnace.

Mr. Frederic Pellatt said, in a question of this kind facts were better than opinions. In his manufactory for many years they used small coal in the melting of glass, the consumption amounting to about 30 tons per week.

Contrary to the prejudices of himself and his workmen, he was induced to try coke. The stokers asserted that it was impossible to get sufficient flame from it to do the work. However, the experiment was made, and the result of a trial of eighteen months was that they practically got from 13 cwt. of coke the same amount of work as was obtained from 21 cwt. of coal. That was a practical fact within his own experience. With reference to the consumption of smoke, he could not say much; but he believed it depended very much upon the heat at which the air was allowed to pass into the furnace. He had lately seen a new invention for heating the air. It consisted of a double furnace door of thin sheet iron, the two being about 18 inches apart. On each side of the door were five or six shelves, and the air being introduced from below, those shelves served to prevent the too sudden rush of the air into the furnace, and the air was heated and passed into the furnace in a very hot state. There was also a double door at the back of the bridge. He believed the furnace he had described to be quite smokeless and very economical, very much upon the same principle as that adopted by Messrs. Doulton, but more easily applied to ordinary boilers.

Mr. Lee Stevens ventured to dissent from the general conclusions arrived at by Mr. Apsley Pellatt. He wished to remind him that, in his statement that not only would 7 lbs. of gas-coke evaporate more water than 10 lbs. of coal, but that the products of gas, tar, &c., arising from the conversion of the coal into coke, would be of higher value than the original cost of the coal, he had altogether omitted to say what the expense of such conversion would be; it being evident that the contents of the retort could not be acted upon without a corresponding expenditure of fuel, labour, &c., which ought to appear on the other side of the account. As regarded the advantages of the use of coke in certain manufactures, such as glass, he had no doubt whatever, because his own information and experience enabled him to verify Mr. Pellatt's, in relation to the application of heat to melting pots, crucibles, cockles, and small reverberatory furnaces. In a few cases, also, coke might be more beneficially used for small steam boiler purposes; but, certainly, not as a rule. The heat from a coke fire, like that from anthracite coal, was a concentrated and not a diffusible heat, but for large steam boilers of all kinds, in which it was desirable to have the greatest amount of heating surface, gas-producing fuel, (and the more bituminous the coal the better,) by affording the means of enlarging and elongating the flame, must, necessarily, be the most economical and effective. Hence, he was convinced that Mr. Pellatt had come to an erroneous conclusion, from imperfect data, having measured the more universal requirements of furnace work, and particularly for steam-engines, by the experiences of his own glass-house. It should also be borne in mind that, where cast or wrought iron had to bear the concentrated heat from coke or anthracite fires —or, in a lesser degree, from that of the semi-bituminous fuel known in London as the smokeless Welsh coal—very considerably increased destruction of the metal took place. His friend Mr. Macgregor Laird thoroughly tried the use of anthracite coal in a line of steamers between this country and the African coast, but was soon compelled to abandon it, in consequence of the rapid destruction of the steam boilers. He would give, in a few words, some information he had that day obtained at the gold and silver refinery of Sir Anthony Rothschild. There he had applied his regulating air-doors to several furnaces in which the Welsh coal had hitherto been used, but which had since been supplied with a more gas (or smoke) producing fuel. Previously the shields, or fire-door guards, had to be renewed every three or four weeks. Since the alteration the new doors remained without repair for about six months. Before the change of doors and fuel, the wrought iron fire-bars were sometimes melted in a single day, and had generally to be removed every week, but now on the average they lasted a month. In the crucible furnaces, however, coke was there, as elsewhere, most advantageously used.

Mr. Benjamin Fothergill had made a great number of experiments in testing on locomotive engines the relative value of coal and coke for heating purposes. As far as his own experience went, he could say that, wherever contrivances were introduced to effect perfect combustion, comparing coke with coal, the saving was tantamount to one-third in favour of coal. Experiments made on the Belfast and County Down Railway had shown that whilst the cost of taking a train with a given number of carriages from one place to another, with coke as the fuel, was £1 17s. 6d., the quantity of coal required to do the same work cost only 16s. 6d. In applying fuel to locomotive as well as stationary boilers, unless they could avail themselves of the extended flame produced when perfect combustion took place, then, to some extent, the smoke would prove seriously detrimental; and when they carried the unconsumed products of combustion along the main flue, or along the sides of the boiler, the carbon collected upon the surface of the flues, and prevented the heat from acting to the extent it otherwise would do. On the contrary, where they could convert the whole of the products of combustion into flame, and then take them through the main flue and along the sides of the boiler, the results were very much in favour of coal. They ought to take into account the enormous expenditure of fuel for converting the coal into coke; and in judging of experiments such as that mentioned by Mr. Frederick Pellatt, they ought to be informed of the relative cost of the coal and the coke, adding to the latter the cost of fuel for making it. He hoped, on a future occasion, he might have the pleasure of reading a paper before the Society on the subject.

Mr. Greaves remarked that he was burning not less than 4,000 tons of fuel per annum, and therefore need scarcely apologise for submitting some practical observations. He stated that he agreed, in the main, with the author of the Paper, but he could not go so far as Mr. Pellatt did in his opinion of the advantage of coke fuel. As he desired his observations to be of a practical nature, he would not enter into any theoretical questions, but merely state that the data he would submit were derived from fuel burnt under steam boilers, commonly known as Cornish boilers, with high-pressure steam. The working of the engines was registered daily, by means of counters recording every stroke, and the coal for every engine was weighed daily, and a strict account kept of it. The experiments extended over five years, during which the engines were working under the same load, and in all respects under similar circumstances. The total amount of fuel from which the averages were drawn, was little short of 10,000 tons, and although during the time many minor variations might have occurred, it was assumed that the length of time and largeness of quantity might be fairly considered to have brought these variations to a fair average. The experiments were commenced in 1852, some time previous to the passing of the Smoke Act, and a good average had been obtained of the efficiency of small coal, or slack, which was taken as the standard. Small coal in London was in quality of a rather superior character, being very much composed of the screenings of best coals. Taking this as a standard, the value of other fuel was given in per centage upon it, and stood as follows:—

Woodd's Merthyr, advantage in efficiency by weight	23·92
Powell's Duffryn	20·11
Nixon's Merthyr	17·31
Anthracite	12·91
Baich-grove ... ... } Resolven, and others of the softer Welsh coals }	13·85
Llangennoch	5 to 10
Holywell Main ... ... } West Hartley ... ... } South Penrith, and other Newcastle steam-coal }	5 to 10

Coke, as generally made by the London Gas Works:—

2,077 tons	12·98
977 ,, ...	14·52
582 ,, ...	12·36

These numbers were obtained from computations which included the efficiency of the engines as well as the boilers, and were, therefore, only comparative figures; taking the highest, however, as corresponding to $10\frac{1}{4}$lbs. of water boiled off per lbs. of fuel, the other numbers would all follow in comparison. He therefore did not feel it necessary to supply the additional data for the boiler duty only; it was, however, obtained by measuring the supply continuously into each set of boilers by attaching there a meter which was continuously at work, and was registered every evening along with the engine strokes for the day. The simple efficiency of the fuel under the boiler could therefore be separated from any deranging effects due to the engine. The erection and attachment of a meter was a most useful and inexpensive precaution. An inch meter would supply 150 to 200 horse power of boilers, and need not cost more than £10. The high ratio of 1 gallon of water boiled off per pound of fuel was only to be obtained in constant day and night work; in cases when fires were drawn, banked up, or when the work was interrupted during each night, a reduction of duty occurred to the extent of from 1-6th to 1-10th; 9lbs. of water for 1lb. of fuel was a very good result when the work was intermittent, but the scale of comparative efficiency was equally applicable at that rate. The rate of burning at which the above data were obtained, was that of $2\frac{1}{2}$lbs. of fuel of the better qualities per horse power per hour, 4lbs. per square foot of grate per hour, and with a draft pressure of 1-10 inch of water in the flues measured at the front of the side flues. This last test was the best practical indication of the quantity of air taken into the furnace, and was much more easily applicable than a direct machine for measuring that quantity. He had informed the Society of the comparative value of these three fuels—Welch coal, coke, and small coal. In coke itself he was not of opinion that there was any very great difference in the quality of the coke produced by the different Gas Works, provided there was no Cannel coke mixed with it. The coke from Cannel was very inferior, very heavy, and metallic, producing very foul fires, and giving great labour and trouble, and from special trial was found only to produce from $\frac{1}{2}$ to $\frac{2}{3}$ the duty of the best quality. The weight of coke was taken at 12 cwt. to the chaldron of 60 cubic feet, dimensions which were settled on exact weighings of large quantities; that bulk a little exceeded the statute size, but was chosen as an even figure. He was in the habit of buying coke always by measure, to avoid the unfair addition of water, the quantity of which that might be absorbed by dry coke was very large indeed, and not only created a loss by the actual weight itself, but as every pound had to be evaporated in the fire instead of in the boiler, it created to that extent a perfect waste of fuel. The limits before mentioned for the rate of combustion were 4lbs. per square foot per hour (not less), but these rates were only obtained where slow combustion was carried on. With reference to the question of smoke prevention, he would observe that it should be borne in mind that there were three things to be mixed in a furnace—coal, air, and heat; that is, that it was necessary that a certain quantity of heat should be present in the furnace in which the coal and air had to be mixed. The greater the heat the more easily would the smoke be prevented, and therefore a heavy hot fire allowed a larger quantity of air being admitted to reduce the smoke that would, without it, arise. Great difficulty occurred with slow combustion in avoiding smoke; he had himself failed in his attempts to prevent smoke from Cornish fires. It might be much reduced, perhaps to one-half, by a large admission of air, but a fall in the duty always accompanied the result. Having more than 16 boilers, all leading to one chimney, of which nine were constantly in work together, he was under the necessity of excessive care, as the united smoke of all the fires soon exceeded parliamentary limits, when any attempt had been made to work bituminous coal. When the rate of burning came up to 10lbs. of fuel per square foot of grate per hour, with a lower rate of boiling off, or duty, it was more easy to prevent the smoke. As to the objection to sulphur in coke he did not believe it to exist. It had often been said and believed that there was more sulphur in the coke than in the coal it came from, and more sulphur in gas coke than ordinary steam coal. Judging, however, that sulphur was a nuisance to the gas-maker, he rather trusted that he would avoid it for his own sake, and that the coke was less pregnant of sulphur than steam coal generally; he had, at least, long experience to show that no damage occurred by it to boilers, and there was a slight diminution in the destruction of fire-bars; this experience resulted in the use of 650 horse-power of engines and boilers in the establishment under his direction. As to the price of the fuels, the average price of small coal might be taken at 11s. 6d. per ton, the lowest price had been 10s., and the highest 12s. 6d. when buying large quantities; the price of coke was not under 19s., the cost in the trade books for eight half-years standing—20s. 7d., 21s. 4d., 21s. 4d., 19s. 3d., 21s., 20s. 8d., 19s. 5d., 21s. 5d. per ton, after all allowance for ingrain and deficiency. Considerable loss from drying also occurred in all fuel, if kept long in covered stores. By this the above prices per ton had been made higher than the market price of coke at the same time, and these corrections were of essential value; fuel, however, could not be too dry for duty. Mr. Greaves hoped those facts would be acceptable to the Society, being his experience in London fuel, burnt in that ordinary way which he imagined to be the object of the author of the paper to have discussed. The calculations had been made with great care, and were reliable data as averages derived from large quantities. The efficiency of the coke and other fuels, as far as they showed an advantage over slack, must be taken as in abatement of the excess in price, leaving the ton of small coal and the ton of coke, in useful effect when unmixed, as eleven shillings and eighteen shillings, the former with smoke, the latter without. The cost of smoke prevention was therefore seven shillings per ton, on all the fuel so consumed as to comply with the Metropolitan Smoke Nuisance Abatement Act of 1853.

Mr. HYDE CLAKE said, in an establishment abroad with which he was connected, the consumption of coals amounded to about 50,000 tons a-year, at a cost of £2 per ton, including freight. Economy of fuel was therefore, in such a case, a question of the greatest importance. Coke had been tried in the same establishment, but without success. There was a fact which ought not to be lost sight of in this discussion, namely, that, by a proper attention to the system of fuelling, a saving of as much as 10 per cent. could be effected. He thought, in a question of this kind, where everything depended upon the conditions under which the experiments were made, they had not sufficient details at present to enable them to arrive at any definite results. In the instance mentioned by Mr. Frederick Pellatt, it was probably a case of fresh coke compared with stale and badly stored coal.

Mr. WENHAM begged to describe a simple and perfectly effective method of consuming smoke, discovered by Mr. Hugh Mair, of Glasgow. It was not the subject of a patent and did not interfere with existing patents, therefore anyone was at liberty to make use of it. It was applied to a short cylindrical boiler having an interior flue containing the fire place. On both sides of the inner flue there were a number of tubes, below the water-level, for bringing the hot-air and flame back

again to the chimney which was placed in front. At the further end of the boiler there was a double iron casing, or smoke-box, which covered the end of the fire-flue and return-tubes. Mr. Mair, finding that this double casing became inconveniently hot, drilled a number of small holes through both the plates, with the view of admitting a current of cold air between them for the purpose of keeping them cool. The immediate result was that it became a most perfect smoke-consuming apparatus. The volume of smoke coming from the fire was thus directly met by numerous jets of hot air passing through the end casing, the opposing currents causing an intimate mixture, and a complete combustion of the suspended carbonaceous matter. So perfectly was this effected by this arrangement, that the chimney could not be *made* to smoke, however bad the fuel (coal) or carelessly the fire might be stoked.

Mr. Blashfield expressed a wish, looking at the great importance of the question, to hear some further explanation of the plan of furnace adopted by Messrs. Doulton, at their works in Lambeth.

Mr. H. Doulton remarked that the present discussion had shown that the relative value of coal and coke depended upon the circumstances under which they were used. He was sorry to hear some little discredit thrown upon scientific experiments, and he felt much indebted to Mr. Wye Williams for the valuable light he had thrown upon this subject. He thought they could only arrive at reliable results by following the careful researches of scientific men. With regard to the relative values of coal and coke, as to their heating qualities he could state that during the last four years he used a considerable quantity of coke in his pottery works, and practically he had found it very advantageous, although he agreed with Mr. Williams, that if they could employ the whole of the bituminous products, coal would be immensely superior to coke. But there were practical difficulties in getting the requisite quantity of air at the right time and in the right place. In fact, in a large body of coal they could not get the air to circulate, and an admixture of coke in such cases was an advantage. In building up a fire gradually, coke might be used with advantage in causing the air to circulate through the fuel and promoting the perfect combustion of tne whole mass. He would add that the carrying power of coke was by no means equal to that of coal, and the success of the experiments already made depended upon the length of the boilers. He did not think coke could be used in very large proportions by potters, for want of carrying power, but a small quantity might be used with advantage.

The Chairman, in proposing the thanks of the meeting to Mr. Pellatt for his Paper, expressed a hope that this subject would be taken up at a future time by some of the gentlemen he saw present, who were so well qualified to treat it. The theory of the matter they were all acquainted with; what they wanted was the results of practical experience.

A vote of thanks was then passed to Mr. Apsley Pellatt.

The Secretary announced that on Wednesday evening next, the 9th inst., a Paper, by Mr. S. Sidney, "On the Progress made of late years in the Manufacture of Agricultural Machines and Implements," would be read.

THE SEWAGE OF LONDON.

By Henry Allnutt.

The drainage of the metropolis for the removal of the sewage is so gigantic an undertaking, and involves so great an outlay, that we should not regret the delay that is occurring before a final scheme can be agreed on, as, from the various suggestions that are continually being made, we may hope at last to arrive at the best method of carrying it out.

As the subject is still under discussion, I beg to offer the following observations:—First, one or two open main drains or channels, of some miles in length, passing through a populous district, must be objectionable; neither is it considered that the mere covering of these long main drains will remove all objections, for poisonous vapour will still be generated from the immense extent of surface, and it will ooze out at all times, especially in warm weather, and during periods when repairs are in progress, and also at the reservoirs. Secondly, the fall (if I understand correctly) of six inches to the mile, for such a thick turbid stream as sewage, I apprehend cannot be considered satisfactory; indeed, from the low situation of the City, and the almost dead level of the river, probably a greater fall cannot be obtained on the margin of the Thames, except by the construction of extraordinary works in a measure regardless of expense. Supposing recourse is had to pumping up the sewage to a higher level, for the purpose of obtaining a better fall, how is it intended to deal with a fall of rain equal to that of the 22nd Oct.? The Registrar-General reports that one-tenth of the total yearly average rain fall for London fell on that day, viz., 2½ inches—being, for the area of London, about 20 millions of tons, or 84 millions of hogsheads. The returns of the Registrar-General show that the amount of rain-fall on this 22nd Oct. equalled the total fall of rain in the month of January last, and nearly that of August last.

A short time ago I visited the sewage works at Watford. No town appears better situated for successful drainage, as it consists of only one street, about a mile in length, with an admirable fall to the works, which are not more than a quarter of a mile distant from the lower parts of the town. But even at Watford, with these advantages of ample fall and short distance, &c., great objections have been urged against the works, and I understood actions at law had been threatened for the abatement of the nuisance.

As the main sewer to the pumping engine is covered, we might feel surprised that annoyance could arise, but I observed an uncovered spot where the odour evidently escaped, which was a small space where a grating was fixed for the detention and removal of paper, rags, skins, hair, &c., obstructions that would soon interfere with and injure the machinery. If, with works so advantageously situated as at Watford, complaints have been expressed, what an outcry might be anticipated with works of such a magnitude and nature as those proposed in the scheme for the drainage of London; therefore, I fear the plan of removing the sewage by one or two main drains of some miles in length, will prove unsatisfactory. And supposing we allow that a channel of so many feet in width will be sufficiently large at the present time, it might not answer a hundred years hence; and where and at what period are we to stop or divide the flow of sewage, and construct an additional drain to convey it to the river or sea, and also make every provision for heavy rain falls?

At Watford they are unable to cope with a heavy fall of rain. When such takes place, I was informed, they shut off the flow of water to the tanks (after about the first half-hour), and suffer it to be discharged into an open ditch, which conveys this overflow to the neighbouring river. This may be also a source of annoyance to the locality, and unquestionably a covered drain should be substituted for the open ditch. No reasonable number of tanks or reservoirs would contain the water flowing through the sewers when heavy rains occur; and if such were possible, the liquid would be of little or no value for agricultural purposes.

When the population of London is increasing so rapidly, and food is required, is it not most unwise to throw into the river that which tends to promote the growth of all vegetables? We might, with equal reason,

cast into the Thames the waggon-loads of manure we daily observe leaving the City for the market gardens.

The sewage of Watford falls by its own gravity into reservoirs, and is then pumped up by steam power, and cast over fields of Italian rye grass, which consequently is cut six or seven times a-year; indeed there appears scarcely a limit to its growth, provided there is warm weather after the application of the sewage.

I submit we should hesitate no longer, but apply our energies not to seek a method of casting the sewage into the sea, but of utilising it: and if the drainage of the metropolis is so complicated and difficult a problem to solve, as to stagger the most clever minds amongst us, why not make an experiment in one district, with the view of using the sewage on the land.

Would it not be possible to drain a district into covered reservoirs, built near to or where a communication could be made with an existing line of railway; the sewage could then be drawn off, or made to flow from the reservoirs (not pumped) into closed railway trucks. Several of these might be filled at the same time; and these trucks could be brought from the reservoirs up an incline to the level of the railway by steam power, and then conveyed any distance into the country.

The system of precipitating the solid parts of the sewage is not recommended, for the manufacture of solid manure occupies too much time, and the expense of so doing, together with the nuisance it might create in the neighbourhood, renders such a process out of the question, at least as applicable to London. It is also asserted by some parties that much of the valuable fertilising properties of the sewage would be left behind in the water, which would be cast away, and so be lost by the agriculturist. Again, it must be recollected that the farmer does not require manure in a dry state, and although receiving the sewage, as here proposed, just as it issues from the drains (without being strained through a grating) involves greater expense in carriage, yet we save the cost of reducing the sewage to a dry state. And above and beyond all considerations, the system I suggest is the quickest way of getting rid of such an unpleasant article.

The closed trucks to hold the sewage should be filled without exposing the sewage to the air, and when filled, the trucks could be conveyed by railway, *by night*, and left at the various stations for, or at, the farms requiring the sewage. There would be no difficulty in having a short single line diverging from the main line* on a raised stage of timber, so that the trucks could be emptied without delay (by valves opening in the botton of the truck) into the middle of a heap of earth prepared for the reception of the sewage, which would filtrate through or be absorbed by it, and form a rich compost; and this could without difficulty be carted to any part of the farm; or the trucks could discharge their contents into tanks formed immediately under the railway stage, so that the farmer could irrigate his fields, or make use of the sewage in any other way he considered best.

This arrangement for discharging the trucks whilst standing on the railroad, *above the depot*, is similar to the plan adopted for unloading coal at many stations.

It will be observed that, adopting the system I have sketched out, there is no necessity for pumping the sewage either into or out of the reservoirs or the trucks, and a large item of expense is thus avoided.

Now, as respects a heavy fall of rain:—First, it could be arranged that all the surface water from rain should be conveyed direct to the river;—this is objectionable, as the sewers may require flushing; but still, after a certain time the current of water from this source could be made to deviate from the reservoirs and flow into the river;—it cannot be supposed that by the adoption of any scheme for the drainage of London, *the Thames will be relieved from every impurity.* Secondly, if the depth of the reservoirs and other circumstances are such as to

* This could not be attempted in a cutting.

render it necessary for flushing, that the rain water must flow the whole course of the sewers down to the reservoirs, then a system of pumping could be adopted to raise *this water only*, and discharge it into the river,—the engine required to draw up the loaded trucks could be employed in *occasional pumping.* It is submitted that after a certain interval for flushing the sewers, the rain water should always be run into the Thames, and probably in most cases the existing sewers would answer this purpose.

It appears, from the return of the Registrar-General, that 22 inches of rain have fallen during the past twelve months, viz., from November, 1856, to October, 1857, inclusive; and that this amount fell on 130 days only, out of which 12·33 inches fell on 20 days, and the remainder 9·67 inches fell on 110 days,—viz., 52 days from 0·01 to 0·05—21 days from 0·06 to 0·10—19 days from 0·11 to 0·15—10 days from 0·16 to 0·20—and 8 days from 0·21 to 0·25 of an inch; furthermore, that the average fall on these 110 days was 0·09 of an inch.*

Now to apply these results to the subject we have in hand, supposing that rain-water does not materially increase the flow of sewage, excepting when the fall exceeds the tenth of an inch, then we find that in 57 days ($19 + 10 + 8 + 20 = 57$) we may be compelled to allow a discharge of rain-water into the river Thames for a few hours each day.

I may be allowed to add that a locality between Kensington and Hammersmith, near the West London Railway, appears well calculated for the experiment I have suggested; and it is probable the chief work to be done in the way of sewerage would be the formation of intercepting sewers eastward to Kensington, Brompton, Knightsbridge, and Pimlico, and westward to Fulham, Hammersmith, &c. In the construction of these sewers, measures could be adopted, by means of sluices, to shut off the rain fall at any time, and cause it to flow into the Thames by its old course.

In conclusion, I have only to repeat, that open or closed main drains for the discharge of the sewage into the river as proposed in the scheme for the drainage of London, should not be adopted; and, further, that manure of every kind is too valuable an article to be wasted, therefore, every endeavour should be made to embody a plan for utilising the sewage; no insurmountable difficulty exists that I am aware of, why an experiment should not be made in one district; and when making this proposition, I am not insisting on the sale of sewage as a remunerative speculation,—but we all agree it must be removed, and if it is valuable on the land, and we can dispose of it at any price, it must be far better than casting it into the Thames a few miles below London-bridge; after all the labour and very great outlay, we shall in that case only remove the nuisance a *degree further from London*, and assuredly shall injure the atmosphere of another locality.

I believe it will be found that the application of the plan I have proposed would be met by the construction of nine sewage works,—six situated to the north of the river Thames, and three to the south of it.

It may be urged, that the removal of sewage in closed trucks by railway would be perfectly impossible, and I admit that the work to be done is indeed immense, but I believe, not impossible if London were divided into districts, and the rain fall allowed to run into the

* On referring to the same returns, I find that on only three days in the year 1855 rain fell 1·00 inch, viz., 11th July 1·42, 26th July, 1·15, and 20th October, 1·06 inches. In 1856, only one day the rain fall amounted to 1·00 inch, that is on the 26th June; we see from this, that it was a most extraordinary fall of rain for Greenwich to amount to 2·57 inches; nevertheless, such a fall of rain may occur again, and every allowance should be made for double this fall if we entertain the idea of pumping up the sewage to a higher level, as two days of such a fall of rain may follow the one after the other.

Thames; we know well, that if the many thousands of people who daily visit the city could only approach it at one point, scarcely any means could be adopted to accommodate them,—it is by the division of labour that great works are accomplished. London is not supplied with gas by one company, neither is there but one water-works; and I cannot avoid saying, with due deference to the opinions of others, that an attempt to draw of the sewage of London and cast it into the Thames (and that river subject to the ebb and flow of the tide) by one or two outlets only, will be more likely to fail than dividing London into districts, and dealing with the sewage as I have endeavoured to point out.

49A, Lincoln's-inn-fields, 7th November, 1857.

P.S.—I wish to remark that I had not seen the report and appendix of the Metropolitan Drainage when the above matter was in type, and it is only on this day that I have had the pleasure of looking over the report and appendix; had I seen it earlier, perhaps I should not have ventured to put forth my views on the subject. I am, however, glad to find that so many other gentlemen advocate the division of London into districts, that the fall of rain should go into the river, and that the sewage should be utilised,—at the same time I do not see that any reference is made to the possibility of removing the sewage as I have proposed. The rain water does not poison the river.—12th *November*.

FAN BLAST.

Mr. C. Wye Williams, in describing the mode he has adopted for many years in ascertaining the amount of draught obtained and of air actually brought into action in the furnace, says:—"This is a point of paramount importance in all inquiries touching the effecting perfect combustion. Engineers take no small pains in measuring the quantity of *coal* used, in given times, in a furnace, yet altogether omit that which is equally essential, and equally susceptible of measurement—namely, the quantity of air supplied. Equally inattentive are they to the providing the relative quantities required by the *coke* portion of the coal, and the *gas* generated in the chambers of the furnace above the charges of coal. This unwarranted and unaccountable omission can only be equalled by that most absurd of all inferences, that the due supply of air for the combustion of those gases may be received from the ash-pit, and through the bars and the solid fuel on them, at a time when those bars are choked up with clinkers. For what could be said in justification of a chemist about to perform a difficult operation, were he to be particular as to the quantity employed of one only of the ingredients necessary for the success of his process, and at the same time to be wholly indifferent to that of the other ingredients, although precise quantities of each were equally necessary? Perhaps one cause of this omission may have been the apparent difficulty of measuring or ascertaining the quantities introduced. This difficulty required first to be overcome before we were in a position to judge of the means for supplying the great volume of air which nature absolutely demands, and the separate quantities required for the *solid* and *volatile* portions of the fuel employed.

"The *absolute* quantity, in volume, of air put in motion by the action of a fan, either in exhausting or propelling, cannot be estimated, since we cannot force or measure the air passing through it as we do through a cylinder of ascertained contents. Air cannot be compressed by the action of a fan without a large loss by its friction. The quantity will therefore vary with each change of the in-draught or exit orifices and the amount of friction to which it may be subjected.

"By the mode I have adopted, however, we come so near the absolute quantity, and obtain such correct *relative* quantities, that practically it satisfies all that may be required."

Mr. Williams's air meter consists of an ordinary circular vane, through which the air has to pass during the operation, producing motion like that of a windmill, increasing in rapidity in proportion to the strength of the current passing through it. This circular motion of the vane is transferred to a series of dials, similar to those of the ordinary domestic gas meter. The number of revolutions of the vane are then recorded in units, tens, hundreds, &c., up to 100,000, thus enabling an experiment to be continued during above 100 minutes. This vane is eighteen inches in diameter, and the inventor having ascertained, by a measured cylinder, after a due adjustment of the leaves, that the quantity passed during a given number of revolutions was equal to one cubic foot for each revolution, has taken that as a sufficiently reliable datum for calculating quantities. The number given by the index dials, then, will represent the number of cubic feet that have *entered* a furnace or been *drawn out*, as the case may be, or escaping by the chimney, under the different circumstances of high or low temperature, with partial or complete combustion.

Mr. Williams adds:—"The vane is hung with such delicacy and is so easily set in motion that the loss by friction of the machine need scarcely be taken into account.

"Among the applications of this meter one may here be mentioned, as it enables us to estimate the absolute and relative value of the draught produced by jets of air or steam when thrown into a chimney for the purpose of increasing the draught. By this means I have been enabled to correct numerous practical errors as to the best mode of economising the steam in the use of the jet under various pressures."

HORTICULTURAL SOCIETY OF LONDON.

An important address to all lovers of horticulture has been lately issued by this Society, for the purpose of opening new channels of communication with every part of the United Kingdom. The address, which is signed by the Duke of Devonshire, the Bishop of Winchester, and all the other members of the Council, and also by Lords Ilchester and Digby, Sir Charles Lemon, Sir Philip Egerton, Sir Thomas Acland, Sir John Ramsden, Sir William Middleton, Sir Walter Trevelyan, Mr. Lawrence Sulivan, Mr. Fox Strangways, Sir Joseph Paxton, Professor Lindley, Mr. Sheriff Mechi, and other Fellows, shows that in the course of 53 years the Society, by its importations and distributions of rare plants and seeds from all countries, by its publications, by its exhibitions of plants and fruits in London and at Chiswick, by giving prizes (alone amounting to above £20,000) to gardeners for conspicuous merit, and by its continued investigation of the qualities of new esculents and fruits, has so changed the whole aspect of English horticulture, that it is now as unusual to see even a badly grown plant as it formerly was to see a good one. The document then proceeds to show that the Society has also expended considerably more than £40,000 upon an experimental garden at Chiswick, which is the only public establishment in the kingdom especially devoted to practical horticulture, and is now maintained for the purpose of showing how high cultivation may be carried out with economy, of bringing to the knowledge of the public whatever is most important in fruits, esculent plants, and objects of decoration, and of exhibiting (in use when practicable) the principal implements employed in gardening. It has been through this establishment that a very large proportion of the most beautiful plants, hardy and half-hardy, which have been added to our gardens since 1816 was originally introduced, and it is felt that with an increased income consequent on an increased number of Fellows, new countries might be still explored with undiminished advantage. The Society therefore earnestly invites the co-operation of all lovers of gardening in the United Kingdoms by greatly diminishing the cost of fellowship, and infusing fresh activity into every department. The pub-

lic has already expressed its approval of these measures by adding no fewer than 197 to the number of Fellows since the 23rd September, 1856, in addition to which a sum of considerably more than £3,000 has been recently subscribed by Fellows and their friends for the purpose of enabling the Society to enter upon a new course of undiminished vigour. The long existence of the Society has rendered this the more desirable because there is now a serious diminution in the number of its supporters, owing to deaths alone; it appearing that it has thus lost as many as 322 in 10 years. The circular is accompanied by a detailed description of the plans of the Society for the ensuing season. It is stated that the country is responding to this appeal with great spirit.

SOUTH KENSINGTON MUSEUM.

During the week ending 28th November, 1857, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,125; on Monday and Tuesday (free evenings), 4,364. On the three students' days (admission to the public 6d.), 316. One students' evening, Wednesday, 129. Total, 6,934.

Home Correspondence.

MAGNESIAN AND OTHER SALTS.

SIR,—Referring to the conversation which I had with you, on the subject of the six salts, which are resultants of my patent processes, (sealed 14 January last) to promote the sanitary and agricultural improvements therein specified, I now beg leave to hand you herewith specimens of these crystals, and to add a short explanation of their nature and uses, which you kindly offered to lay upon the Society's table at its first meeting, along with these crystals.

It would have been more satisfactory to me to have read a paper before the Society, and to have answered any questions which the scientific and medical members of the Society might have put. But this cannot be accomplished at present.

The first series of crystals laid on the table is a double salt.

1. Phosphate of ammonia and magnesia, well adapted for scrofulous diseases and softness of the bones.

2. The second specimen of beautiful crystals, is also a double salt. A sulphate of magnesia and ammonia.

3. The third series of crystals is a double chlorate of magnesia and ammonia.

4. The fourth specimen of very minute crystals is rather a precipitate, and is a triple salt not hitherto used for health or husbandry, nor produced by art for these objects until now. It is sparingly evolved by nature in urinary and other secretions, and is composed of equal parts of phosphate of magnesia and phosphate of ammonia, both well suited, when thus combined, to restore strength to bones and tissues, and to afford phosphoric acid and ammonia to crops, in a far more economical and durable manner than can result from the too soluble superphosphate of lime, or the sulphate of ammonia now used, which, in wet soils, are carried off by floods. Three tons of rain water dissolve one ton of either manure in the single state, as now applied to crops.

These double salts, however, are ten times less soluble, and, of course, ten times more permanent.

This triple phosphate is still more durable in lands than even the double phosphates; it is slowly dissolved by common salt or other muriates, and gradually gives out its nourishing elements as wanted by the plants. It is the white sand of Dr. Woollaston.

The fifth salt is a double one, namely, phosphate of soda and magnesia.

The sixth double salt is the phosphate of potassa and ammonia.

I now come to submit a brief account of the principle agents and *modus operandi* for generating the gases and their effects as motive powers, and as generators of the salts before you.

The compression of liquids by a gas pushing them up by the tension of a new atmosphere, self-injected, and driving up water to any useful elevation without steam-engines, pistons, or friction, may seem a costly operation. But the value of supplying good water to towns and rich liquid manures to farms—of generating these crystals containing all great manuring elements—of impregnating drainage with carbonic acid, and of supplying a force to scatter it over soils,— all these advantages more than repay the first cost of the raw materials used, and sometimes leave new resulting products free of expense.

The materials affording this self-acting propulsion are plentiful and cheap. When mixed in sewage they abate offensive smells and obnoxious miasms, and displace or dilute infectious airs in crowded localities.

Carbonic acid gas is here liberated from dolomite, either by mineral acids or by calcination in retorts with other carbonates. The gas is carried along with vapour, superimposing such a tense elastic pressure on water as to force up many hundred tons of sewage per day, with grit or silt, which do not pass through valves or locks by pumping. One square yard of dolomite or marble yields 16,000 cubic feet of fixed air, which, at the moment of its expulsion from red hot retorts, expands and displaces above 36,000 cubic feet of water, equal to about 1,000 tons of drainage.

One ton of dry bones liberates 300 cubic feet of fixed air which is now lost by super-phosphate makers, but by my patent manipulations, it is driven into the farmers' tanks to force up its contents imbued with fixed air, which is the natural food of plants. Another result from bones was hitherto lost, namely, the ammonia; but by my plan, ammoniates and phosphates are produced sufficient to unite with the excess of bicarbonate of magnesia, which arrests them all, and converts them into these double and triple salts, which are thus saved by this agent from melting away into subsoils and rivers.

An elastic compression results also from the evolution at their nascent temperature of ammonia, hydrochloric and sulphurous acid gases; separately generated and self-injected, they produce with animal drainage or exuviæ the four salts presented to the Society.

As the sources of carbonic acid are boundless, so also are its agricultural benefits. It dissolves bones and limestone in soils, arrests and fixes ammonia, melts magnesian limestone, and forms the bicarbonate of that earth in a fluid state which I first produced and applied efficiently as a medicinal preparation in 1808.

Bicarbonate of magnesia in excess is now acknowledged to be the best deodoriser of bad breath and offensive emanations.

Sulphurous acid gas is another agent in our works, and a powerful disinfecting one. It was so used against pestilence in the Grecian camps at Troy, where Homer relates that they diffused this gas by burning sulphur in iron pans. It is now cheaply made by burning pyrites.

Hydro-chloric acid gas is also a disinfectant. It is produced from pyrites with common salt. The soda cake left in the retorts pays first cost, and is a salt valuable for soils.

Ammonia can be abundantly obtained from gas works, or by calcining coal dust and animal exuviæ, thus affording a light elastic gas, which, like the others, if driven over liquids at the temperature of its evolution from the retorts, propels such liquids to any required place or service.

I am, &c.,

JAMES MURRAY.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 2. General Monthly Meeting.
Entomological, 8.
TUES. Syro-Egyptian, 7½. I. Exhibition of Egyptian Antiquities by Sir Charles Nicholson. II. Mr. Samuel Sharpe, "On the Inscriptions in the Jebel Mokhatab—'the mountain with writing.'"
Civil Engineers, 8. Mr. T. Sopwith, M. Inst. C.E., "Account of the Nile Ferry, at Kape Azayat, Egypt."
Med. and Chirurg., 7½.
Zoological, 9.
WED. Literary Fund, 3.
Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. S. Sidney, "On the Progress made of late years in the Manufacture of Agricultural Machines and Implements."
Graphic, 8.
Microscopical, 8.
Archæological Asso., 8½.
THURS. Royal Society Club, 6.
Antiquaries, 8.
Royal, 8½.
FRI. Astronomical, 8.
SAT. Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November* 27.]

Dated 27th July, 1857.

2044. Frederick Bonaparte Anderson, 56, High-street, Gravesend, Kent—A mechanical slow match for submarine or other mining operations.

Dated 15th August, 1857.

2174. George Tomlinson Bousfield, Loughborough-park, Brixton—Improvements in the preparation of dough for bread, pastry, cake, and other farinaceous articles of food. (A communication.)

Dated 20th October, 1857.

2684. Charles Tooth and William Watkin Wynne, Burton-on-Trent—An improved refrigerator or apparatus for cooling or attempering liquids.

Dated 23rd October, 1857.

2701. William Henry Hine Akerman, Bridgewater—Improvements in organs and similar musical instruments.

Dated 26th October, 1857.

2712. Isaac Jones, St. Helen's, Lancashire—Improvements in the manufacture of sheet glass.
2714. John Horrocks, Manchester—Improvements in winding machines, and in the bobbins employed therein, and also improvements in shuttles for weaving with such bobbins.
2716. James Ferrabee, Phœnix Iron Works, and Charles Whitmore, Stroud—Improvements applicable to machinery for carding, scribbling, and condensing wool and other fibrous substances.

Dated 27th October, 1857.

2718. William Clarke, Laybourne-road, Camden-town—Improved means of connecting and working breaks for railway carriages.
2720. Thomas Mottram, Rockingham street, Sheffield—Improvements in knife handles.
2722. Robert Alexander Margetson, Norwich—Improved means of communicating between the guard and driver on railways.
2724. Robert Urie, Paisley, and William Sutherland, Penelope Works, Greenock—Improvements in the manufacture of knitted and weft-netted warp fabrics.

Dated 28th October, 1857.

2726. Colonel Henry John Daniell, Donington-park, Derby—Improvements in communicating by signals between the pilot and steersman, and between other parts of vessels by means of dial apparatuses.
2728. Johan Ernst Fridrich Luedeke, Birmingham—A new or improved motive power engine.
2730. Pierre Adolphe Melchior Maury, Paris—Improvements in cutting the pile of velvets and other pile fabrics.
2732. Aimé Bourgeois, 457, New Oxford-street—An improvement in preparing liquor for tanning hides and skins. (Partly a communication.)
2734. Joseph Sloper, Oxford street—Improved means of, and apparatus for, obtaining motive power for propelling ships or driving machinery.
2736. William Clark, 53, Chancery-lane—Improvements in the manufacture of murexide. (A communication.)
2738. William Edward Newton, 66, Chancery-lane—Improvements in the manufacture of sewing silk, twist, and different kinds of thread. (A communication.)
2740. John Child, Loveday-street, and Joseph Child, Howard-street, Birmingham—A double-barrelled gun, with an elevated rifled tubular rib.
2742. John Fraser, Glasgow—Improvements in the manufacture of saltpetre.
2744. William Greening, Lower Edmonton—Improvements in enamelling and ornamenting metals and other surfaces.

Dated 29th October, 1857.

2746. Daniel de la Cherois Gourley, Wilton-house, Regent's-park—Improvements in ambulance carriages.
2748. Thomas Cook, Old Kent-road—Improvements in machinery for cutting, framing, and packing lucifer and other like wood matches.
2750. William Padgett, Poole—The manufacture of earthenware pipes for drains and sewers.
2752. Ephraim Smith, Carlisle-street—An improved safety hook or fastening, particularly applicable to securing watch chains and watches to waistcoats and other garments.

Dated 30th October, 1857.

2754. John Evans, Lower-road, Islington—Certain improvements in the method or methods of affixing or securing patterns and designs upon rollers and blocks used for imprinting on paper and other substances.
2756. Henry Charlesworth and William Chapman, Huddersfield—Improvements in machinery or apparatus for preparing woollen or other fibrous substances to be spun.
2758. William Shields, Salford—Improvements in machinery or apparatus for etching, engraving, and cutting cylinders and other surfaces, to be used in printing and embossing.
2760. Joseph Davy and William Bentley, Bradford, Yorkshire—Certain improvements in looms for weaving.
2762. Thomas Symes Prideaux, 32, Charing cross—Improvements in apparatus for regulating the supply of air furnaces.
2764. Malcolm Stodart, 1, Golden-square—An improvement in the construction of the sound boards of pianofortes.

Dated 31st October, 1857.

2766. Henry Jean Viault and Jules Viault, Paris—An apparatus or mechanism for making signals on railwdys, and preventing collisions on the same.
2768. Thomas Lowe, Birmingham—A new or improved method of feeding screws, blanks, shanks, pins, and other such like articles, to turning, nicking, and worming lathes or machines.
2770. Leon de Landfort, Higher Broughton, near Manchester—An apparatus for protecting the contents of pockets of wearing apparel from theft and loss.
2774. Peter Gabbitas, Worksop, Nottingham—Improvements in washing machines.
2776. Joseph Fry, Watling-street—An improvement in cementing fabrics when india rubber is employed.
2778. James Lee Norton, Bow, Middlesex, and Edwin Wilkinson, Leeds—An improvement in extracting oil and grease from wood previous to its being manufactured into yarn or fabrics, and also when in the state of yarn or fabrics, and in scouring or cleansing such wool, yarn, or fabrics.

WEEKLY LIST OF PATENTS SEALED.

November 27th.

1505. Milivoi Petrovitch.
1526. Edouard Alexandre.
1527. Moses Clark, Henry Oldfield, and William Salmon.
1539. Frank Perks Fellows.
1540. William Henry Walenn.
1573. William Miller.
1589. Edmund Knowles Muspratt and Balthasar Wilhelm Gerland.
1624. Joseph Sharp Bailey.
1652. Charles d'Ambly.
1660. Robert Mushet.
1696. Gustave Margfoy.
1711. James Champion.
1763. Henry Genhart.
1991. William Cliff.
2245. George Wirgman Hemming.
2430. Thomas Webster.

December 1st.

1553. Newton Bentley and John Alcock.
1559. Edmond Roy.
1577. Thomas Latham Boote and Richard Boote.
1592. Hiram Powers.
1603. Edgar Brooks.
1650. Benjamin Noakes and Frederic John Wood.
1655. Eugène Barsanti and Felix Matteucci.
1665. Alfred Vincent Newton.
1671. William Edward Newton.
1794. Robert Hattersley.
1825. Thomas Hardcastle.
1832. Thomas Brewer.
1875. John Alison.
2181. Richard Talbot and Benjamin Croasdale.
2290. Thomas Bradford.
2410. John Smith Barden, Aaron Watkins Rockwood, H. Hinkley, and D. Franklin Child.
2449. John Absterdam.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

November 23rd.

2485. James Hartley.
2491. Richard Roberts.
2512. Sydney Smith.
2585. John Thom.

November 24th.

2513. John Moore Hyde.

November 25th.

2494. Walter Blundell.
2525. Joseph Whitworth.

November 26th.

2519. John Mason and Leonard Kaberry.

November 27th.

2503. Thomas Restell.
2510. George Gowland.
2521. John Sands.
2523. Frederic Le Mesurier.

November 28th.

2528. Julian Bernard.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4034	Nov. 26.	A Lever and Cutter for Shot Pouch Top	James Dixon and Sons	Sheffield.

Journal of the Society of Arts.

FRIDAY, DECEMBER 11, 1857.

EXAMINATIONS.

The following circular has been issued to the Institutions in Union with the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, London, W.C., December 4, 1857.

Sir,—With reference to the Circular Letter of the 25th ult., and to the Programme of Examinations for 1858, which accompanied it, I am instructed to direct your attention to the *Journal* of this day, the 4th of Dec., which will be found to contain a full report of the proceedings of the Special General Meeting of the Society, held on the 1st inst.

You will see that the Bye-laws, passed in February last, the operation of which the Council had suspended, on the ground of their illegality, were revoked as illegal, and that the new Bye-laws which the Council proposed, to enable them to reconstitute a Board of Examiners, in conformity to the Charter, were unanimously adopted; and the following resolution was passed by a very large majority :—

" That this meeting, while it recognises the value of Oral Examinations, continues to have entire confidence in the Council of the Society, and entrusts to it the working out of the question of Examinations among the Institutions in Union."

For the reasons briefly stated in the Address of the Chairman of the Council which was delivered at the opening of the present Session, and appeared in the *Journal* of Nov. 20, the Council are convinced that it is quite impossible for the Society of Arts to examine orally, on any fair and satisfactory system, all the Candidates that may be ultimately expected to be presented by the Institutes in union throughout England, Wales, Scotland, and Ireland, when the system of examination shall have become fully developed; but the principle of Oral Examination, in combination with Examination by papers, has always been appreciated by the Council as highly valuable in those cases where it is possible to guard against the capriciousness and risk of unfairness which are obviously inherent in the Oral system.

If the Candidates for examination were to be few, and capa[illegible] of being brought to a single centre, the Council would certainly [illegible]have them examined both orally and by papers; but in the case wi[illegible]th which the Council have to deal the Candidates ought in a few [illegible]years to be counted by thousands, and they cannot afford either the [illegible] time or the money which would be requ[illegible]ired to convey them to, and to maintain them at, places of Exam[illegible]ination distant from their own homes and from the scenes of their daily labour.

The object to be aimed at by the Council is, that, throughout the whole Union, wherever there is class-instruction, the students of the classes should have the advantage of Examination. The funds contributed by the Institutes in Union ought to be so expended by the Council of this Society as to afford to all parts of the Union, as far as possible, an equal amount of advantage. It must be borne in mind that the Union comprises Institutes ranging from St. Austell to Aberdeen, from Margate to Belfast, and from Limerick, through Wales, to Lowestoft.

The Council had no little difficulty last summer in obtaining the services of even four gentlemen who were able to go from London to Huddersfield as Examiners; no one has as yet attempted to show to the Council by what means it could obtain the services of an adequate number of the Members of the Society's Board of Examiners simultaneously at the five places which were proposed: and the Council are quite satisfied that, even if five centres of Examination would meet the wants of the Union, which is obviously out of the question, it would be impossible for the Society of Arts to send simultaneously to those five centres the requisite number of Examiners adequately representing the authority of the Board and giving uniform judgments. It must also be remembered that the Oral Examination of such large numbers, simultaneously in many places, has not only never succeeded, but has never been even attempted; and that experience has abundantly proved that very large numbers can be well examined simultaneously at many places by written papers.

But there is still another difficulty—the difficulty of time—which involves also the difficulty of expense. A hasty Oral Examination is admitted to be the worst possible test; and every one can calculate for himself the length of time that would be consumed by the full and careful Oral Examination of the very large number of Candidates that ought ultimately to be expected if justice were done to all the Institutes in the United Kingdom.

These are only a few of the difficulties which make it impossible for the Society of Arts to extend the Examinations of its own Central Board otherwise than by papers. The Council, however, are of opinion that the previous examinations by the Local Boards may with advantage be conducted orally as well as in writing. Each Local Board, however, should determine this point for itself.

It has been alleged that men unable, or scarcely able, to write will have no chance of succeeding in an examination which is not oral. This is admitted; but it never could have been intended that the Society's Central Board of Examiners should examine persons who cannot write. The object of the central and final examinations is—not to provide for such exceptional cases, but—to promote the best possible education of the greatest possible number of persons connected with the Institutes in the Union. Writing is one of the first elements of education; and, as such, is properly to be tested by the previous examinations of the Local Boards. No Candidate who cannot fairly write ought to be presented to the Central Board.

It was stated, at the Special General Meeting, that, even in the great towns of Yorkshire, the Local Boards could not satisfactorily discharge the duties which the programme invites them to undertake, and that there would be suspicions of partiality, unless the local authorities were assisted by the presence of at least one member of the Society's Board of Examiners. The Council cannot entertain this idea. It is absolutely contradicted by the experience of Local Boards in Yorkshire, Lancashire, Cheshire, South Hants, Wiltshire, Devonshire, Berkshire, and London. The Council believe that there [illegible] but few places where the formation of an efficient can be [illegible] Local Board able to conduct a previous and impartial [illegible]lly difficult. In all cases, how- Examination would be rea[illegible] will do their ever, where difficulties arise, the Council [illegible] best to assist in removing them, if invited by the local authorities to do so, by transmitting to any Institute an explanation in detail of what has been already done in forming Local Boards in various places; and, if necessary, concerting with the Institutes for sending an officer of the Society to assist them in organizing their plans.

By order of the Council,

P. LE NEVE FOSTER, *Secretary*.

FOURTH ORDINARY MEETING.

Wednesday, Dec. 9, 1857.

The Fourth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wed-

nesday, the 9th inst., James Caird, Esq., M.P., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Charles B. Clabon.	Eugene Rimmell.
Joseph Farrar.	John Edmund Willis.

Previously to the reading of the Paper, the Secretary called the attention of the meeting to some small working models, shown by Sir James Murray, illustrating the power to be obtained by gaseous pressure on the surface of liquids in close vessels, with a view to its employment as a force for drainage purposes, whilst the salts in the sewage are utilised for agricultural purposes, as referred to in Sir James Murray's letter in last week's *Journal*, page 47. Some further explanatory observations on this head will be found at page 65 of the present number of the *Journal*.

The Paper read was :—

ON THE PROGRESS OF THE AGRICULTURAL IMPLEMENT TRADE DURING THE LAST TWENTY YEARS.

By S. Sidney.

The paper which I am about to read this evening, is an attempt to trace the progress of the agricultural implement trade between the years 1837 and 1857. I say *trade*, because during the last twenty years the "progress" has been created and supported rather by a steady and increasing demand, which has led to important improvements in the details of the manufacture of agricultural implements, than by any extraordinary mechanical inventions, such as the Jacquard loom, the power loom, the self-acting mule, which have, from time to time, completely revolutionized the cotton and silk trades.

I have selected, and shall endeavour to confine myself to, the period that has elapsed since 1837, because, during that period, four circumstances, viz., the importation of guano, the manufacture of superphosphate of lime, and other artificial portable manures, the promulgation and general acceptation of Mr. Josiah Parkes' system of deep thorough drainage, the extension of the railway system, and the annual exhibitions of the Royal Agricultural and Local Agricultural Societies, have combined to raise to the mechanical perfection only to be obtained under the factory system, and to bring into common use a number of implements and machines which had long ago been invented and described in quarto volumes, some of which had been in use in one or two counties, but which, in 1837, were considered, if known by the mass of English farmers, as curious useless toys.

Let me state, at the commencement, that I am not about to read a paper on the use of agricultural implements, to the many first-class farmers who will probably be present, in spite of the attractions of the Smithfield Club dinner. I am not so impertinent and presumptuous as to attempt to teach those from whom, during the last fifteen years, I have learned almost all that I know on agricultural questions. My object is to afford to that large class, who get their meat from the butchers, and their bread from the bakers, without troubling themselves about the origin of either, some idea of the vast amount of mechanical ingenuity and agricultural experience which has been devoted, during the last twenty years, to making inferior soils fertile, and fertile soils more productive, to economising time and labour in every operation of husbandry, so as to keep pace, as far as soil and climate would allow, with the daily increasing demands of our town population. I feel sure that when you have followed me through my attempt to sketch the various mechanical aids which, within the period under notice, have been brought to bear upon the several operations of land drainage, the preparation of the soil for seed, the gathering of crops, and the preparation of crops for market, you will come to the conclusion that no standard manufacture has made more solid and rapid progress in England, within the last twenty years, than that of bread and meat.

I say England, because it is a curious fact that Scotland, which originated and adopted several cardinal improvements in agricultural implements fifty, and even a hundred, years before England, is now, in agricultural mechanics, at least, twenty-five years behindhand.

Scotch agriculturists make shift with barbarous implements, that have been discarded by all our best farmers ; and where Scotch farmers use improved ploughs, drills, hoes, and threshing machines, they usually obtain them from English manufacturers.

With these preliminary observations, I will proceed to the subject of the evening, which I propose to treat, not chronologically, but, in the order in which the operations of modern agriculture are conducted.

Perhaps the greatest, certainly the most profitable, improvement of modern agriculture, is that obtained by deep drains, cut with tools and laid with porous earthenware pipes, which were practically unknown in 1845. In that year, at the exhibition of the Royal Agricultural Society, at Shrewsbury, a portable horizontal drain-tile machine, on a principle since become universal, was produced, which could make 20,000 pipe tiles in ten hours ; two years previously, the first tiles exhibited had been made one at a time. In the following year, Mr. Parkes produced, at his Newcastle lecture on the principles of deep drainage, a set of the tools for cutting deep drains, which are still in use. The principles Mr. Parkes had been years considering, and maturing by experiment, but he rightly considered it useless to make them public until he could find a machine for manufacturing, with economy and rapidity, a suitable conduit pipe.

It is not necessary to enter here into the details of either the theory or the practice of thorough draining. It will be enough to state that with the help of tile drain machines and tools first made public in 1845-6, there have been, up to the present time, upwards of two millions of acres drained. By this process many hundred thousand acres of land previously in waste, or only fit, at best, for poor pasture, and many hundred thousand acres of retentive clays which could only bear corn in favourable dry seasons, have been brought into a regular rotation of arable cultivation, in which roots, the foundation of first class farming, take their place, and are even fed off by sheep.

Perhaps this is one of the most striking instances of great agricultural results from very simple mechanical assistance,—a clay pipe made by a machine that any labourer can work.

We will, then, suppose our soil rendered dry, porous and warm, better able to receive and absorb the fertilizing rain and atmosphere by a network of drains. The next work is to turn up the soil ; to bury weeds deep enough to cause them to decay, so as to add to instead of exhausting the fertility of the soil ; and to expose retentive soils to the mellowing influence of the winter's frost.

For this purpose we resort to the plough and the cultivator; spade digging is usually too slow, for even the horse plough is not fast enough to overtake the work that ought to be done before winter's rains and snow stop all autumn work.

It is not my intention to devote any considerable part of this paper to a consideration of the ancient history or modern curiosities of the plough—the most ancient and most universally useful of agricultural implements.

In the south of Europe ploughs are in use, even more primitive in construction than those employed by our Saxon and Norman ancestors, constructed either wholly of wood, or with the share armed with a thin point of wrought iron. And it must be admitted that, in a

warm dry climate, on the light soil which alone is devoted to corn-growing, in thinly-peopled, semi-barbarous countries (barbarous, speaking agriculturally,) a very rude implement, of no great strength, is sufficient to effect the slight stirring of the soil required before the seed is carelessly broad-casted. Nature does the rest, and on such a soil a genial sun often produces crops exceeding in quantity and quality the best returns of the best cultivated fields in our humid and more rigorous climate.

In England, the plough is not only required to bury the weeds and stubble, but to cut, move, and turn over a damp tenacious clay soil, often covered with a thick tough skin, the result of a crop of artificial grasses trampled and eaten closely down by sheep.

Twenty years ago, when the Royal Agricultural Society of England commenced the annual exhibitions which form the more prominent, and, certainly the most useful part of their operations, there were two or three ploughs constructed on very good principles in use in two or three English counties, but it is a curious fact that even the plough makers had but loose, vague opinions on the comparative merits of the forms of the ploughs they manufactured. At that period, the Ransomes, of Ipswich, had been manufacturers of ploughs for nearly a century; they had introduced, at the beginning of this century, several substantial improvements, for instance, cast-iron shares, case hardened on the sole, which were not only much cheaper than wrought iron shares, but had the essential advantage of sharpening themselves when at work, because cast-iron sides wore away more rapidly than the case-hardened sole. But in the then state of agricultural intelligence and opinion, the Messrs. Ransomes made as many as eighty different kinds of ploughshares, of which some were good and some were bad, in order to accommodate the local prejudices of every county into which they sent travellers. At present, in common with all first class ploughmakers, they decline to make an ill-shaped plough to please any county or customer.

It would be impossible, within the limits of this paper, to describe the various kinds of ploughs that were in use, even amongst first-class farmers, in 1837. It will be sufficient, for the purpose of illustration, to mention that in a series of experiments instituted in 1839, by the late Henry Handley and the late Philip Pusey, two of the most intelligent founders of the Royal Agricultural Society, and in trials for prizes made at the meetings of the Society at Liverpool and Cambridge, in 1841 and 1842, the greater number of ploughs tried were of wood, with the exception of the share and the coulter. In several the mould board was also of wood. The greater number were swing ploughs, in which, being without wheels, the depth is regulated by the line of draught and the skill of the ploughman; some of them had one wheel, others had two high wheels, of equal size, and a cumbrous arrangement like the old wheeled ploughs of our Saxon ancestors, called "A gallows;" while two counties only, Bedford and Rutland, made use of ploughs with the two wheels of unequal size, of a model from which all the best ploughs in England at the present time have been constructed, and on which Messrs. Howard, of Bedford, have established their world-wide reputation.

On further examination of the details of the construction of the best ploughs produced in 1837, it will be found that the coulter, the wheels, and the other parts requiring occasional adjustment by the ploughman, were made fast by the clumsy expedient of wooden wedges. The well-shaped iron Scotch swing plough, and the well planned Beds and Rutland modern wheeled ploughs, were the exceptions twenty years ago. In almost every county there were to be found barbarous ploughs, of home construction, with wooden beam, wooden breast, wrought-iron share, and on the swing principle, with one fixed stilt and one loose stilt. Generally a hedgestake

"Contrived a double debt to pay—"

a handle for the ploughman and a spud with which at frequent pauses he cleared the share of adhesive clay, or poked down the furrow, which "would insist on rising" behind the breast of his plough.

In 1837, and, indeed, up to 1842, the principal English agricultural writers wrote and argued that the swing plough worked with less labour for the horses, that is, less friction, than the wheel plough.

At the present day, in all the best cultivated districts of England, the ploughs in common use are almost all constructed on the principles of the one exhibited on the floor, one of Howard's P.P. ploughs, with more or less excellence of detail, according to the skill of the manufacturer. For many years past, no other form has had the slightest chance of winning a prize at the trials of the Royal Agricultural Society, and I am not aware of any instance in which it has not been successful at local ploughing matches. In the last trial at the Royal Agricultural Society's show, at Carlisle, in 1855, the swing ploughs, which local prejudice still retains in use there, as it does in Scotland, were signally defeated.

In Paris, at two exhibitions, the English form of plough was found as superior in mechanical arrangement as in materials.

It does not fall within the plan of this rapid sketch of the history of agricultural implements, to describe every variety of the half-dozen ploughs, for different soils and purposes, which every first-rate farmer has in use. These may best be studied in the illustrated catalogues issued by each maker, or, better still, in the department devoted to agricultural implements at the Crystal Palace.

Within twenty years, the *subsoil plough* brought into notice by Smith, of Deanston, for stirring and sometimes bringing up the soil, between the surface and drains, has been established as a standard implement, and is manufactured by all our established plough-makers.*

Mr. Bentall has attained a high reputation for the broad-share plough which bears his name, which can be used either for paring away a stem of stubble and weeds immediately after harvest, or, with an alteration of its parts, as a subsoil, "Bentall's broad-share" being one of the few absolutely new implements produced since 1837.

The harrow is as old, if not an older implement than the plough. In Australia, after rudely ploughing the dry soil, the settlers sow their seed broadcast, and cover it with a harrow of bushes, made as much as possible after the directions of Gervase Markham, two hundred years ago, who tells his readers to "get a pretty big white thorn tree, which we call hawthorn, and make sure that it be wonderful thick, bushy, and rough grown," &c.

But a modern harrow is required for covering seed, for breaking the surface clods of rough ploughed land, for loosening the surface of the soil, and thus allowing the air access to the roots of the plants growing on it, and for gathering weeds to the surface.

On the Continent, where iron is made costly for the benefit of ironmasters, the harrows are entirely of wood. In the oldest English agricultural works in which harrows are delineated, we find the teeth of iron, and the frame work only of wood, and that was the construction almost universal before the exhibitions of the Royal Agricultural Society commenced, and for some years afterwards. At present harrows entirely of iron are extensively used, and are daily gaining ground in agricultural favour, not

* In the *Museum Rusticum*, 1766, a Mr. Randall, of York, advertises a set of subsoil ploughs, viz., "A loosening plough, that goes one foot deep without either mould or coulter, so as to cut the ground 18 inches wide, leaving the soil in its place.—A lifting plough, to gather the soil so loosened, and make a clear trench 18 inches wide, and one foot deep.—Another lifting plough, with a broad wheel under the plough, throws it upon what the soil had raised up before."—*Communicated by R. W. Blencowe, Esq., of Lewes, to the Editor of the Bath and West of England Journal.*

only in England, where they are, looking at their efficiency and durability, more economical than wooden frames, but even in France, in spite of the heavy protective duties on iron.

The form of iron harrow most esteemed is that first introduced by Messrs. Howard within the last twenty years, the form being zig-zag, with the teeth so arranged that each cuts a separate track at equal distances, and furnished with joints in the centre, which allow the frames to adapt themselves to the form of the ridges.

There is a century of agricultural progress between the continental wooden harrow and the simple, effective, durable iron zig-zag!

In addition to harrows, there are a number of powerful implements, under the names of scarifiers and cultivators, with curved tines of iron or steel fixed into a frame of wood or iron, which were known certainly twenty years ago, but which only became standard implements within the brief period that has enabled farmers of every county to exchange their respective opinions and experience. Among these Biddell's scarifier and Coleman's cultivator deservedly hold a high place. I mention them particularly, because, although the idea of such implements may be traced back nearly fifty years, their present form and materials, cast-iron frames, with wrought iron and steel teeth, are the result of mechanical facilities which have only been created within the period of progress sketched in this paper.

The soil having been ploughed and harrowed, and, if needed, scarified, or dragged, rollers come into use, either before or after the crop is sown, and here we again meet with striking instances of the advantages we enjoy from cheap iron and cheap conveyance.

To crush down the clods—"horses' heads" they are called by country folks—which *will* defy the efforts of ploughs and harrows, our fathers used rollers of wood and stone, and sledges heavily loaded, as the French and German farmers do still, and often employed labourers armed with heavy hoes, called in those times by the then familiar, now forgotten, name of clodders. Our rollers are now almost invariably made of cast-iron. A dozen iron rollers were exhibited by as many manufacturers at the Salisbury show in July last. The first invented, and the most celebrated and most universally effective is Crosskill's clod-crusher, which consists of "a number of cast-iron discs, of two alternate sizes, placed side by side upon a round axle, from five to six feet in length, so as to revolve independently of each other. The outer surface of each roller surface being serrated with a series of sideway projecting teeth, which cut perpendicularly in breaking clods."*

This roller is used, 1st. For crushing clods on heavy clay land. 2nd. For rolling corn as soon as sown on light land, so as to solidify it. 3rd. For rolling wheat upon light land in the spring, after frosts and winds have left the plants bare. 4th. For stopping the ravages of the wire-worm and grub. 5th. For rolling turnips in the rough leaf before hoeing, when the plants are attacked by the wire-worm or grub, and for many other purposes in this country and on the continent.

Crosskill's clod-crusher was invented in 1830, ten years before railways created agricultural travellers. It was by the merest accident that this valuable implement was not broken up for old iron, after being three times exhibited without obtaining any notice or honorary reward. But it was at length purchased, and tried by some score of enterprising agriculturists, the first being a clergyman, a cousin of the late Sir Robert Peel. Mr. Pusey published a chapter of testimonials to the value of the clod-crusher, and in the same year, when it was in full operation in many counties, the Society presented the inventor with its gold medal.

Having with the modern ploughs, harrows, scarifiers and rollers, reduced the soil, whether strong clay, rich loam, or light sand, to a condition fit to receive the seed, sowing is the next operation.

Twenty years ago the roots, in all but two or three of the more advanced counties, and nearly all the corn crops of England, were sown by hand, broadcast. The sower went forth to sow with a sheet, knotted into a bag, before him, and with an even swing distributed the seed over the land, where the regular furrows made by the plough were a great assistance in securing an even distribution of the crop. In those days, sowing was an act which was carried to extraordinary perfection; a clever broadcaster would broadcast fifty acres without making the difference of half-a-peck an acre.

More than a hundred years have elapsed since the ingenious and unfortunate Jethro Tull invented a machine for sowing corn in regular rows, for the purpose of admitting the use of his horse-hoe. Tull's system of cultivating by stirring the soil without manure, being only half a truth, failed, and his plans of mechanical cultivation fell into undeserved neglect.

Between 1782 and 1800 several drills were invented, the best, according to Mr. Allan Ransome (in his "Implements of Agriculture"), being by the Rev. James Cook, of Heaton Norris, Lancashire, which is delineated and described in the 5th volume of the *Letters and Papers of the Bath and West of England Society*, and bears a strong resemblance in outline to the modern drill.

But drills made no progress in public favour until turnip culture, with purchased portable manures, was introduced into Norfolk, in order to economise rape cake, the only artificial manure. One of the first used in Norfolk was invented by a blacksmith, for the father of Mr. Hudson, of Castle Acre, fifty years ago. Five and twenty years ago, the drill, manufactured then as now, by the since widely-known names of Garrett, of Leiston, Smyth, of Peasenhall, and Hornsby of Grantham, was scarcely to be found beyond Norfolk, Suffolk, and Beds, in a few counties where the Norfolk rotation had extended. The use of the drill spread in proportion as the use of artificial manures spread. Since 1837 an enormous trade and manufacture of portable manures, applicable to both root and corn crops, has been established, and the trade in drills has followed step by step the trade in guano, nitrate of soda, and superphosphate. At the late Exhibition of the Royal Agricultural Society at Salisbury, twenty-three exhibitors, from almost every agricultural district of England, appeared on the ground with drills adapted for every purpose and every kind of land, with from three rows to fifteen rows, able to deposit manure on one side or under the seed; to sow corn, turnips, mangold wurzel, clover, and small seeds; to broadcast artificial manures over growing crops; to wash in manures with water; to sow on hill sides; in fact, to meet every requirement of the farmer—the universal use of purchased manures having compelled the equally universal use of the economising action of the drill. Yet, in 1837, the drill was scarcely used out of Norfolk, Suffolk,

* In the *Museum Rusticum*, already quoted, Mr. Blencowe also finds in 1750 the rudiments of the spike rollers described by a correspondent, "A Young Farmer." This roller is of oak, 6 feet 3 inches long, 17 inches in diameter, hooped with iron at each end; rows of iron spikes are set in the quincunx order, at 6 inches distance one from the other in the rows, so that there are 13 spikes in one row, and 12 in every other throughout the circumference. The number of spikes is 225, projecting about 4½ inches. Every spike will weigh about 1¼ lbs. In the spring of 1752, I had 50 acres designed to be sowed with barley, when, the spring being dry and the weather extremely unfavourable, there was no such thing as preparing the ground for seed. I sent for workmen, and produced this useful instrument against next morning. On that morning a neighbouring farmer passed by us with half the country for clotters, as we were going to put our horses to the roller. He gazed on the roller, and went his way with the troop. They, after clotting two acres, returned the same way at night. Their master rolled his eyes all over a field of above 20 acres, saw it was perfectly fine, and after a pause said, "I was a good hedgehog for doing ten times more than his troop in one day, and ten times finer than a thousand clotters could in the same time.'

and Bedfordshire. In 1851, it was difficult to find a man able to sow broadcast, and a Norfolk farmer has been obliged to invent a broadcasting machine for top-dressing corn with artificial manures.

The horse hoe, to cut up weeds and stir the soil between roots or beans, follows the seed drill, as a matter of course, along the perfectly straight lines of vegetation produced by the machine sowing. The earliest horse hoe was Jethro Tull's, but that was a sort of plough, not the least like the invaluable implement which is identified with the name of Garrett, the "Inverted Horse Hoe," or the other horse hoes now in use.

The original of this implement is to be found in an inverted horse hoe, invented by the late Francis Blaikie, nearly fifty years ago, when agricultural agent of the late Earl of Leicester, to follow the rude drill already mentioned. This was one of the very many valuable contributions to agricultural progress made by Mr. Blaikie, while in the service of a landlord whose extraordinary exertions and extraordinary success in establishing a new system of cultivation, and in turning a waste of sheep walks and rabbit warrens into the best corn land of England, is familiar to every student of the agricultural history of England. The horse hoe does in time what no possible number of hand hoers could do at all.

The old form of plough horse hoes buried the plants; the modern horse hoes, whether inverted or of triangular shape, travel close between the rows, cutting up weeds and stirring the earth without doing the slightest damage, even when the rows are very near each other. One man and a boy, with this implement, can hoe from 10 to 15 acres a day, at a cost of about 6d. an acre. It was as little known as the drill, out of Suffolk and Norfolk, in 1841, when it was exhibited and rewarded at the Royal Agricultural Society's show at Liverpool. But, like the drill, the use of the horse hoe has received a much more powerful stimulus from the invention of portable root manures, and specially from Liebig's superphosphate of lime, in 1844-5, than from any number of exhibitions or prizes. It is not enough that an agricultural implement is ingenious; it must be profitable in time or money saved, if it is to be the subject of a great standard trade.

In the drill and the horse hoe, which have made such rapid conquests over agricultural manual-labour prejudices, since the age of railroads began, we find not only a saving of hand-labour that can be otherwise more usefully employed; not only a saving of time, so invaluable in our weeping uncertain climate; not only a saving of manure too costly to be wastefully distributed, but a combined mechanical war upon weeds, which under the system of broadcasting, were often sown with the seed, and thus filled the place and exhausted the fertility due to food-producing plants.

As to the progress in the manufacture and sale of these twin implements of high-farming, I may venture to assert that there is not a respectable ironmonger in a country town in England, who has not drills and horse hoes on sale alongside of the ploughs and ploughshares, and harrows of the best model, if not the best manufacture.

Having thus far rapidly sketched the economy of time, labour, seed, and manure, which mechanical science and skill have brought to bear on draining, ploughing, harrowing, dragging, rolling, drilling, and horse hoeing, I will make a leap over the minor intermediate processes, and proceed to consider the present condition of the implements for gathering crops.

Here the improvement within twenty years is very striking and very rapid. Necessity, in this part of agriculture, left our farmers little choice. A frightful national calamity, in one year, swept away hundreds of thousands of haymakers and reapers, the pith and marrow of the itinerant bands of Celts who yearly crossed the Irish Channel to gather Saxon crops.

Farmers were slowly converted to the use of the best forms of iron wheeled ploughs, iron harrows, cultivators, scarifiers, drills, and horse hoes, by example, by speeches, and by reports, but it was the dearth of labour suddenly created, and unexpectedly maintained by famine, an enormous emigration, and war,—which forced the way for the progress of the haymaker, the horse rake, and reaping machines.

I shall not attempt to describe the several haymakers, all on the rotary principle, each of which, with the aid of the horse rake, does the work of forty men or women, making hay better and more quickly than the best disciplined hand-labour.

There are half-a-dozen makers, the names best known being those of Smith and Ashby, of Stamford, and Nicholson, who established a reputation at the Salisbury show this summer. All are founded on a plan patented by Robert Salmon, of Woburn, (an ingenious mechanic, patronized by Francis, the great agricultural Duke of Bedford,) in 1816. Salmon also invented the well-known excellent Bedford drill, and many other capital improvements in agricultural implements, but he was a quarter of a century before his time. There were too many paupers, too much surplus labour. Conveyance and coals were too dear in 1816. But his mechanical labours have since borne good fruit and done good service to the state; while more fortunate than many inventors, he was appreciated and rewarded during his lifetime by the nobleman who did for Beds what Thomas Coke, Earl of Leicester, did for Norfolk, and the first Lord Yarborough for the Wolds of Lincolnshire.

The first haymaker in the shows of the Royal Agricultural Society was exhibited at Liverpool, in 1841, by Wedlake, and rewarded with £3, but there was no great demand before 1850; since that date the demand has been, at every show, greater than the leading traders could easily execute.

Reaping Machines stand next in time and importance to the haymakers.

These, like so many other agricultural implements, were invented long before they were needed. The first working machine, like the drill, we owe to a clergyman, the Rev. Patrick Bell, who, for his amusement, invented the reaper now so well known as Crosskill's Bell. He made it, when a student, with his own hands, with the assistance of his brother and a country blacksmith, in 1828, and tried it for the first time in a shed, where he had planted stalks of corn, as children make gardens with cut flowers; then successfully in an open field; and, finally, for thirteen seasons, cut his father's crops.

But although Bell's reaper was rewarded by the Highland Agricultural Society, a quarter of a century ago, and worked on his father's and brother's farms for many years, it was not needed. Reapers and mowers were cheap, and clamorous for employment, so it lay forgotten in his brother's farm, until, at the Great Exhibition in 1851, an American, M'Cormick, exhibited a specimen of a reaper on a totally different plan to Bell's, which, under the strong pressure of necessity, had been invented, manufactured, and extensively sold in the thinly-peopled districts of the United States, for nearly twenty years. Another American quickly followed with the reaper, now so well known as Dray's, and, lastly, Bell's was exhumed from the obscurity of the Inchmichael Farm.

The American Reaping machine arrived at an epoch when the absence of the accustomed armies of itinerant Irish labour had not only raised the wages of hand-reapers and scythemen very considerably, but caused a delay of a very serious character in getting in ripe crops. Bell's machine was improved by borrowing one of the American knives, and other details. The American machines were altered and strengthened, in order to meet the requirements of the heavy English crops, and, after six years' experience, in Yorkshire, Lincolnshire, Norfolk, and Bedfordshire, during which the supply of itinerant labour has rather diminished than increased, it is safe to affirm that

the three reapers named have become standard implements, for which there is a regular and increasing demand in all the best farmed districts of England and Scotland. When properly worked, with four horses and two men each, they clear off crops of wheat and other grain at the rate of from ten to fifteen acres a-day. Machine reapers not only enable farmers to get in the corn harvest without the assistance of wandering strangers, but also to make the most of snatches of fine weather, and to save time for carrying out autumnal cultivation, on which the success of root crops so intimately depends.

When a farmer engages a band of mowers and scythemen, he must cut right through his crops and lay the dead ripe and the half-green sections equally into sheaves, because his nomad assistants want to finish, and be away into the next parish, where they are expected; but with machine reapers the farmer can take advantage of an interval of fine weather, and cut from day to day just so much of the corn as may be ripe.

Hitherto the progress of the reaping machines has been delayed by the contradictory decisions of the Royal Agricultural Society, and by the weakness and imperfections in the workmanship of the machines manufactured during the years 1851-2, before the requirements of our heavy crops were fully understood; but during the harvest of 1857, the doubts of the most prejudiced were dissipated by the example and testimony of tenant farmers of high and well-deserved reputation, and henceforward Burgess and Keys M'Cormick, Crosskill's Bell, and the Dray's Hussey, which have all in turn been rewarded by the Society, must necessarily follow over the ground on which modern iron-wheeled ploughs, drills, horse hoes, and clod-crushers have preceded them.

I have now brought you as far as the Harvest Home. I shall not pause to describe the latest invention, Doctor Guyot's loom for weaving straw matting, which renders easy and rapid the important operation of thatching, or temporarily covering wheatstacks without the assistance of a professional thatcher, but I will proceed at once to the place where the last operation—threshing—is performed before the grain passes from the hands of the farmer into those of the manufacturer—the miller.

Within the last twenty years the whole system for preparing corn for market has been completely changed, by the inventions of our agricultural engineers. Not only has the flail been superseded by the threshing machine, and the horse-driven by the steam-driven threshing-machine, but the threshing-machine itself, instead of being a mere box for beating out the corn in a rough way, as it was less than ten years ago—leaving all the subsequent operations of winnowing, dividing, and dressing the corn to be performed on separate occasions by different machines—has now been so perfected and extended, that wheat is beaten out of the ears, and the straw carefully shaken, carried away into the loft while the grain is winnowed, the cavings separated from the chaff, the light corn from the best, and the light corn again divided into best-tail, light-tail, and whites, and the whole sacked and weighed ready for market. The last two operations are, it must be admitted, rarely practised except where one purchaser takes the whole wheat of a farm; because it is advantageous to dress all the corn of the same quality at once, in order to secure an evenness of sample; without this precaution the quality of each sack of corn would vary with the degree of ripeness or weight of each field or part of a field.

By the help of steam-engines, to which I shall presently allude, this complete transformation of wheat ricks into wheat fit for market and straw fit for use, on the farm, is performed at the rate of 100 to 150 quarters (800 to 1,200 bushels) per day, at the rate of 2s. 6d. per quarter.

To thresh and dress the same quantity by hand would cost 4s. per quarter, and occupy ten men from 160 to 240 days. The saving on the wheat crop of England, estimated at 12,000,000 quarters, would amount to £1,500,000.

Threshing machines, driven by water or horse-power, have been in use in Scotland more than a hundred years, and as soon as steam-engines became cheap in that country, they were employed instead of horse or water-power. A machine for threshing grain was invented and patented, in 1732, by Michael Menzies, a gentleman of East Lothian, on which the Society of Improvers in Scotland reported that "the machine would be of great use to farmers, both in threshing the grain clean from straw, and in saving a great deal of labour; for one man would be sufficient to manage a machine which would do the work of six." Other patented inventions for the same purpose followed, but it was Andrew Meikle, of Lymingham, East Lothian, the son of James Meikle, the same who in 1710 was sent over to Holland by the celebrated Fletcher of Saltoun, to learn "the perfect art of sheeling (i.e. winnowing) barley," who invented a threshing machine upon the same principle upon which the greater number of machines in use were constructed up to 1843.

But although twenty years ago a fixed threshing-machine, driven by horse, or wind, or water, or steam power, was to be found on almost every arable farm of more than 100 acres in the Lothians of Scotland, in England, where water-power was scarce, where leases with the security of tenure essential for the safe execution of fixed improvements were the exception, and, most (formidable barrier of all,) when under the old Poor Law, farmers were burdened with the support or compulsory employment of labourers who were nearly as tightly confined to the circle of the parish as if they had been mere serfs, *adscripti glebæ*, the soul-deadening, brain-stupifying flail was in full possession of nine-tenths of the barns and ricks. It is true that, more than half-a-century ago, a few great landlords had fixed threshing-machines, which are described by Arthur Young, and appear now very costly in proportion to the work they executed. An attempt, about the years 1829-30, to introduce portable horse-threshing machines into the south-western counties brought about incendiary fires and riots, in which not only the labourers, but respectable small farmers took part, and with which some of the higher classes were ignorant enough to sympathise. One small farmer was hanged for firing barns at Salisbury, in 1830. In 1857, the labourers, in sight of Old Sarum, cheered loudly on witnessing the success of the reaping machines.

In 1830, the greater number of farmers in the disturbed districts were frightened into selling their horse machines, and one of the now eminent agricultural implement makers bought back scores of machines at nominal prices.

When, in 1839, the Royal Agricultural Society held its first meeting at Oxford, horse threshing was slowly making way against the prejudices of the labourers, the farmers, and the squires. Even in 1847, the prejudice against machine threshing was to be found lingering among squires and great farmers, but necessity conquers all prejudices.

Under the old system of flail threshing, corn was beaten out for market not when required, but when the labourers of the farm had nothing else to do.

In wet weather, the very worst weather for so dealing with corn, the grain having previously been carted into the barn from the ricks, was knocked out on the floor, more or less dusty, with more or less success, according to the skill of the thresher and the state of the weather. On an average, as much grain was left in the straw as would now pay for steam threshing; for that reason fowls thrive better where the flail still survives. The grain mixed with the impurities of the floor, trodden on by the nailed shoes of the thresher, lay heaped up until the time came for hand winnowing, offering in hard times a strong temptation for each thresher to carry

home as much as he could conceal for the use of his family or his pig.

No matter how pressing the demand of the market, the farmer could only realise his corn crops when the slow irregular manual work had been dragged through in an uncertain number of days.

After the riots there was an attempt to conciliate the prejudices of the labourers by hand-driven machines, but these were as hard to work as the flail, and in some counties the farmers returned to horse machines at the request of the labourers themselves. For English use, the portable steam-driven threshing machine has been invented, and although not equal, either in economy or efficiency, to fixed barn machinery, it is an invaluable machine, because it enables one machine to do the work of many farms, and enables the farmer to save carting by working at the side of ricks built on distant fields, and in the course of a day to turn from seven to eight hundred bushels of wheat into the next thing to cash, if a railway station lies handy. Portable steam driven machines have enlarged the trade of those local mechanics who do good service by hiring out what many farmers are unable to sink capital by purchasing. Less than seven years have elapsed since, under the influence of railways and the great annual fairs of the Royal and other Agricultural Societies, steam-driven threshing machines and barn machinery have been brought to their present perfect and economical condition.

As for flail-threshers, the difficulty in the best cultivated counties is to find a man who will consent to take a flail in hand. You must seek these antiquated instruments of stupefaction, either in very remote rural districts or in the metropolitan counties, Surrey, Bucks, and Essex, where, curiously enough, specimens may be found of the worst system of cultivation and the most barbarous implements. Shallow bush-draining—roots broadcasted—wooden breasted, one-stilted, swing ploughs, and flail threshing.

Having brought the principal crop of the farm into a marketable state, fit to be sent by rail to the corn-factor, to be pitched at market in bulk, or carried in those little calico bags in which the true British farmer keeps his corn-samples and his money; having shown how, within twenty years, every operation has been rendered more perfect in execution, more economical in money payment, and in most instances much more rapid, I must not conclude this faint sketch without saying something about the most modern and most important mechanical aid to agricultural progress—the steam-engine. Steam-engines were practically unknown on the farms of England twenty years ago; in the counties where they were most needed, the coal and the means of transport from the manufactory were alike wanting.

A portable steam engine (on the disc principle, which totally failed), was exhibited at Liverpool in 1841. Yet, in 1843, the manufacture and letting on hire of travelling engines to drive threshing machines, was mentioned by Mr. Pusey, in the Royal Agricultural Society's report, as having become a regular business, although "the Fire Insurance Companies charged an extra one per cent. where they were used."

In 1846-7 the demand for portable steam engines and threshing machines was so well established and steady, that a large capital was invested in erecting a great factory in Lincoln, for the sole purpose of manufacturing agricultural steam engines and threshing machines.

This establishment has, up to the present time, turned out upwards of two thousand steam engines, lately at the rate of five hundred engines per annum, and this great trade has been done without trenching upon the business of the half-a-dozen manufacturers who preceded Messrs. Clayton and Shuttleworth in that particular branch of the agricultural implement trade. In the catalogue of the show at Salisbury in 1857, I find not less than twenty exhibitors of fixed and portable engines, including the names of Hornsby, of Grantham, Clayton and Shuttleworth, of Lincoln, Barrett and Exall, of Reading, Cambridge, of Bristol, and the Ransomes, of Ipswich, whose names are all identified with the more important features of the mechanical displays of the Royal Agricultural Society. The continuous supply is the best evidence of the continuous demand—a demand created and supported by easy and cheap conveyance of iron, coal, manufactured machinery, and agricultural crops, and by a labour market which has, for the last ten years, been drained by internal and external migration from the rural districts to manufacturing towns at home, and colonies beyond the sea.

The agricultural steam engine is the essential adjunct of every well cultivated farm within the influence of a railroad and telegraph station. Under the charge of an ordinary farm labourer, an engine of from five to eight horse-power drives the barn machinery, cuts chaff or roots, crushes oats, grinds corn, pulps mangold wurzel, splits beans, saws wood, pumps water, and lends its boiler for steaming potatoes or roots, while men and horses are more usefully employed in other regular work of the farm. "And what," some of my auditors may at this point feel inclined to exclaim, "about steam ploughing?" Why very little this evening.

This subject so zealously investigated at the present moment is too large to be treated in a paragraph, but I will venture to state that the farmers of England, in this year 1857, are ripe and ready to receive and support a steam cultivator, which will perform its work as efficiently, if not as economically, as the threshing machine and the drill; indeed, it is not a substitute for horse-power that is so much required as a machine which can be used at a time and under circumstances when no number of horses could do the work required.

The cost of ploughing and cultivating easily or naturally drained soils is so low (from seven to fourteen shillings per acre), and is performed so efficiently with modern implements and good horses, that I confess I do not see, even looming in the distant horizon, any steam arrangement which, on light-land farms, is likely "to seal the doom of the plough," to use a favourite phrase of Mr. Mechi's; and this opinion of mine is shared by the most advanced agriculturists and the most distinguished engineers.

But there are in this country vast tracts of retentive adhesive clays which, in the best seasons, require an enormous amount of horse-power to work, and in wet seasons cannot be touched at all. No team is strong enough to draw the plough; no horse's foot can touch such soil without permanent injury. If a machine can be contrived which can be set to work the moment the crop is off the ground—when horses and men are most busy,—a machine which can execute its ten acres in daylight—if it can work on by moon-light or lamp-light, so much the better—then thousands of acres of first-rate corn-land, such land as is to be found in the Wealds of Sussex and Kent, in Dorset and Oxfordshire, can be turned up and cleared of weeds before Christmas, thus exposed to the mellowing influences of winter frost and snow, sown early in spring for root crops, and brought into regular rotation, which now for want of horse-power, or in consequence of a wet season, can never be touched until spring, and then grow as many weeds as roots or corn. A machine that would do all this would earn £1 an acre from a clay-land farmer. Towards this desired end Messrs. Fowler and Ransome, and Mr. Smith, of Woolston, have been working in a manner which holds out good hopes of success, and if they do succeed—not in cultivating well—that they have done—but in cultivating economically, they will increase the value of the arable land of the country as much as it has been increased within the last ten years by the promulgation of the cardinal agricultural improvement of this century, "Parkes's system of thorough-deep drainage."

I have not left myself room to say much about the simple yet invaluable machines for preparing food for

stock—the root-slicer, pulper, and chaff-cutter. The first and last were invented in their present shape, before the epoch I have selected for illustration, for the use of the root-growers and winter feeders, in counties where grass and hay were scarce commodities, but their use has become within twenty years universal instead of local.

The demand for meat, and the extension of drill-root husbandry (the foundation of all of our high-farming) has raised the sale of the machines for economising cattle food from hundreds to thousands. That mutton and beef can be sold at less than famine prices—that we are not driven back to the salt meat of our ancestors—depends, more than ordinary town-customers of the butcher would believe, on the artificial manure which Liebig suggested, distributed by the drill, to nourish the roots, which, sliced by Gardner's famous machines, help to convert lamb into mutton at an age when it used to be lamb. The pulper for preparing roots for fermentation is a modern invention for carrying out a modern process of feeding without cooking.

Here my rapid and imperfect sketch of the progress of the agricultural implement manufacture since 1837 ends. It is not, you will observe, an account of antiquarian curiosities or mechanical toys, or of costly machines, only to be found on the fancy farms of wealthy landlords, but of the implements and machines which are for sale in every county, and almost every parish of England, which engage in their manufacture a fixed capital that cannot be estimated at less than one million sterling, which have called into existence, or raised from small beginings, at least six establishments, in each of which from 500 to 100 mechanics', and as much more steam-power are regularly employed.

When I remember what great factories are to be found in full work for the agricultural interest in Ipswich, Leiston, Bedford, Lincoln, Grantham, and Beverley, I feel justified in asserting that in spite of barren, undrained blanks of bad farming still to be found, there is no manufacture which has made more progress in proportion to the limits of nature than the British manufacture of beef, mutton, and bread.

Mr. J. Evelyn Denison (the present Speaker of the House of Commons), in his report on the Agricultural Department of the Paris Exhibition of 1855, made some calculations of the national expenditure and saving from the modern system of cultivation carried out by modern tools, of which I will avail myself, extending Mr. Denison's estimate to 1857, and, including some items he omitted. Within six years, upwards of ten millions have been invested by landholders in draining two million acres of land, on principles and with tools and pipes which were, practically speaking, not known and invented in 1845.

The difference in ploughing drained and undrained land Mr. Denison estimates at 2s. an acre (how much land is drainable, out of thirty millions under plough, I cannot estimate) but I believe the difference between the use of the best modern, and the old wooden swing plough, is at least 6d. more per acre.

An improved drill saves at least a bushel an acre in sowing, and gives a better and more certain crop; in fact, with artificial manure, which can only be usefully applied to a drilled root crop, secures twenty-five tons an acre on what would not have yielded five tons without the drill. At present prices, the saving of seed alone by the use of a corn drill, instead of broadcasting, would amount to full 1s. 6d. per acre on wheat, and 1s. on barley. The saving by the steam-driven barn machinery Mr. Denison estimates at 2s. 6d. per quarter for wheat, and 1s. 3d. for barley. In the absence of correct agricultural statistics, I must leave to others the task of calculating the total national saving obtained by the substitution of iron for wood, horse-power for man's power, and steam-power for horse-power!

But the greatest, the most important saving obtained by the use of the implements and machines produced in the factories of our agricultural engineers, is not in manual or even horse labour, but in *time;* hours, days, weeks—invaluable in our weeping uncertain climate, which were wasted and lost when the flail flourished and the drill was a curiosity, are now turned to profitable account. Land is broken up, seeds and manures are sown, corn is gathered, hay is made, grain is threshed out; within time and under circumstances that would have been as much out of the reach of the last generation of farmers as a journey from London to Liverpool in ten hours, or a sale in Smithfield of cattle feeding fat twenty-four hours previously near Aberdeen.

One word more before I bring to a close this long, and I fear wearisome paper, on the cause of the concentration, within the last twenty years, of the application to profitable uses of so many inventions, which were made and used by a select few in previous generations.

It is the fashion among a certain class of more respectable agricultural magnates to attribute this rapid progress to the prizes distributed at the shows of the Royal Agricultural Society; the pet phrase is, that "the Council have grown small blacksmiths into great engineers." An examination of the records of the Society induces me to doubt whether prizes have, on the whole, had a useful effect. In my opinion, they may at times be useful for directing mechanical invention into some new unexplored track; they may be useful where competitive trials are possible, by amusing and interesting the by-standing public and thus creating publicity; but they also cultivate a class of mechanical toys and complications which are not improvements. Prizes for the standard implements of agriculture, awarded after trials that decide nothing in the eyes of real farmers, are as absurd as prizes for printing presses or locomotive steam-engines. I understand rewarding a ploughman with a few pounds for personal skill, but not a ploughmaker who manufactures ploughs by the hundred.

The chemist who gave us portable manures,—the engineer who gave us railways and telegraphs,—who made coal and iron cheap and markets near,—who made Agricultural Implement Shows possible and profitable, and forced the stay-at-home race of farmers to travel in order to see with their own eyes and hear with their own ears; these created facilities and incentives to agricultural progress which could not be resisted,—these gave us "the three things" that Lord Bacon said, three centuries ago, "made nations great and prosperous,—a fertile soil, busy workshops, and easy conveyance for men and commodities."

DISCUSSION.

Mr. Bentall rose for the purpose of correcting a statement made in the early portion of the paper, with regard to the introduction of machinery for the manufacture of drain-pipes. He could testify to the fact that, forty years ago, Dr. Baker, of Malden Hall, in Essex, had a machine of that description in use in that district, which, according to the author of the paper, was in so backward and unenlightened a condition. He (Mr. Bentall) was, in fact, himself engaged in superintending the castings of a similar machine, in his father's foundry, as much as twenty-seven years ago.

Mr. James Howard thought that there was one point to which sufficient prominence had not been given, that was—that the great advance in agricultural machinery was not, in his opinion, so much attributable to the skill and energy of the machine-makers themselves as to the growing intelligence of the farmers, who, as they advanced in knowledge, felt the necessity for a better and higher class of machines, and the demand for that description of machinery had produced the supply.

Mr. Richard Garrett fully endorsed the opinion just expressed by Mr. Howard. With reference to the more recent improvements in drills, the name of Mr. Thomas Chambers, of Norfolk, should be especially

associated with a machine for the distribution of liquid manure, and great improvements in that descriptions of implement were introduced by Mr. Chandler and Mr. Spooner. With regard to the horse-hoe, with which his own name had been connected, he would state that the only merit to which he laid claim, was the application of a lever to the hoes, so that each hoe acted independently of the rest, and adapted itself to the irregularities of the soil. The implement referred to by the author of the paper as having been in use forty or fifty years ago, and having been invented by Mr. Blaikie, was similar to that now so generally in use, only not having the separate adjusting lever.

Dr. MATTHEW TRUMAN differed from the author of the paper as to the utility of giving rewards for inventions. Although it might be difficult to trace the discovery of any great mechanical invention to the circumstance of a premium offered for that object, yet in the aggregate he regarded the giving of rewards for such purposes as of the greatest importance. It had struck him that one of the greatest defects of which they had to complain in the present day was the alleged impracticability of turning the sewage matters of large towns to profitable account for the purposes of agriculture. He believed that arose in a great measure from the want of proper stimulus to the investigation of the subject, in the shape of a commensurate reward. It was all very well to say that the reward would naturally accrue to the person who made the successful discovery; but in the absence of such an incentive as the offer of an adequate prize would afford, the matter could only be undertaken by the formation of a company, and it was well-known that, generally speaking, scientific men were the worst commercial men in existence; and there was little inducement for them to devote their time and energies to make discoveries of that nature. Many cases, however, might be mentioned in which the most striking results had followed the offering of premiums for important discoveries. Dr. Truman proceeded to illustrate this remark by an allusion to the high premiums offered by the great Napoleon for the successful introduction of the manufacture of sugar and gunpowder in France, at a period when all the French ports were in a state of blockade.

Mr. ROBERT BAKER had attended for the purpose of listening to what had proved to be a very able paper on the subject of agriculture, but he confessed, as an Essex man, he had not expected to hear the attacks which had been directed against the farming in that county. Taking the statement of Mr. Sidney himself, that his own experience in agricultural matters did not extend beyond a period of ten years, it was fairly to be presumed that he had not had much opportunity of investigating, at least from personal acquaintance, the farming of the different counties of England, much less, probably, that of Essex, which was a metropolitan county, for here the adage would hold good that a man knew less of what was passing around him than of what occurred at a distance. For that reason, perhaps, the author of the paper had formed some erroneous opinions with regard to the agriculture of the county which he (Mr. Baker) represented. Although, perhaps, he could not claim for the Essex people the title of the best farmers in the kingdom, they could, at least, enter the lists with any other portion of the country in the manufacture of agricultural implements and machinery. There was present in the room a gentleman who, he ventured to assert, represented a firm who had done as much for agriculture, in the shape of invention and manufacture, as any in the kingdon,—he alluded to Mr. Bentall. Mr. Sidney had dated all the improvements in the plough from the year 1837. The Messrs. Bentall had invented a plough, nearly or quite equal to that which Mr. Sidney appeared to regard as the model implement, fully 20 years before that date, and it had been extensively used in Essex. The Messrs. Ransome followed in the same course, and produced excellent ploughs even at that time. The case-hardening of one side of the share, gave the pre-eminence to the Essex plough. The old wooden plough had been gradually superseded by implements manufactured entirely of iron, but he was of opinion that in Essex there was as good ploughing forty years ago as at the present day. Although the implement was of a ruder character, yet it effected the object as well as the modern ploughs. Another very important point, was the comparative cost between threshing by hand and steam. He believed the farmers present would agree with him, when he asserted that the difference the author of the paper had asserted to exist between the two, was not borne out by practical experience. It had been stated, that wheat threshed by the flail, cost 4s. per quarter, whilst with the steam-threshing machine it was done for 2s. 6d. per quarter, and upon that basis, Mr. Sidney calculated a saving to the farmers of the country of a million and a-half of money. He (Mr. Baker) denied that statement *in toto*. There were persons in Essex who kept threshing machines to let on hire. One person had as many as six machines, in the neighbourhood in which he resided, and only last week an advertisement appeared, offering to thresh corn and perform the operations of dressing—all hands found—at 3s. 6d. per quarter—the farmer, he presumed, providing the coal for the engine—whilst it could be threshed by the flail and dressed for 2s. 6d. per quarter; and, therefore, flail threshing, though not so expeditious, was the cheaper of the two. He had not attended that evening with any intention or desire to disparage the use of these improved implements. He had always been an advocate for progress in agricultural machinery, and the first idea of the broad share plough was obtained from an implement which he (Mr. Baker) had brought out, the idea having been taken up and improved upon by Mr. Bentall. If, therefore, the farmers stimulated the manufacturers of machinery, he believed more would be achieved than had hitherto been done.

Mr. J. D. MAHON, having returned from a visit to several agricultural shows in Ireland, and the recent exhibition in Waterford, could state that there had been extensive displays of implements and machinery from all parts of England, and some from abroad. He thought the premiums offered at their shows had a beneficial influence. Ireland, not being a manufacturing country, had all these scientific improvements brought to her doors, and the Irish farmers were enabled to avail themselves of machinery brought from great distances, which, he was happy to say, they were now entensively using.

Mr. J. J. MECHI thought it very important that no misapprehension should exist with regard to the comparative expense of hand and steam threshing. He had used a fixed steam engine on his own farm for ten years, and, practically, he found that he could thresh his long-strawed mown wheat at 1s. 6d. per quarter, including every cost. In that respect there was a great discrepancy between the statement of his friend Mr. Baker and his (Mr. Mechi's) practical experience. Working with his machine, he could thresh 30 quarters per day, in which 16 men, women and boys were engaged, whose wages could be easily calculated, taking those of the men at 11s. per week, and the women and boys in proportion. The coals were at the rate of 1s. per cwt., about 10 cwt. per day being consumed; and, allowing the ordinary charges for the use of the machine, he could not put the expense at more than 1s. 6d. per quarter, making a difference of more than one-half between the calculations of Mr. Baker and the results of his own practice. He had even been given to understand that Mr. Hudson, of Castleacre, threshed his corn at an average of 1s. per quarter. Under these circumstances, he thought it ought not to go forth that hand threshing was cheaper than machine threshing. Mr. Mechi alluded to the great advantages which he expected to result from Halkett's guideway steam cultivator, upon a system of rails laid

down on the farms, an important element of which was the facility with which the heavy root crops could be conveyed from stiff clay lands. He did not admit that Essex was at all a badly-farmed county. His opinion, from what he had seen, was that it ranked amongst the best-farmed counties of England, although, no doubt, the Essex people were surpassed in some districts of Bedfordshire and Lincolnshire in the quantity of food they produced.

Mr. Walford had noticed, with some interest, the remark made in the paper, that many important inventions and improvements in agriculture had emanated from clergymen, whilst the majority of improvements had not been introduced by practical farmers. It was singular that the farmers themselves should have made comparatively so few improvements in the implements which they employed; and, if clergymen had been instrumental in effecting these improvements, he apprehended they had done so by virtue of superior education. They must, therefore, look to the education of the farmers to make more rapid progress, and, at a time when so much attention was paid to the education of the tenant farmers, they might hope that the progress in this direction during the next twenty years would be far greater than that which had taken place during the period embraced in the present paper.

Mr. Thomas Scott said, the remarks of Mr. Baker suggested that it was necessary for gentlemen to rise up in defence of their respective localities. With respect to the north (from which the reaping and threshing machines had emanated) having been distanced by the south, he did not think the meeting would agree with Mr. Sidney. With reference to the system of agriculture in Scotland, he would state that it was hardly possible to go upon the premises of an intelligent farmer there, without finding a melancholy pile of discarded implements patented in the south; and they had before them the fact that, at all events, the Scotch system of agriculture realised good rents to the landowners, profitable returns to the tenants, and far better wages to the labourer than was the case in the south. With regard to steam threshing, he was of opinion, with Mr. Mechi, that with a fixed engine it could be done at 1s. 6d. per quarter, and on this matter he spoke from the results of experience over two thousand acres of wheat. He should like to hear from Mr. Baker, whether in Essex they paid the labourers sufficient wages to enable them to keep up the physical condition necessary for the hand labour which that gentleman appeared to advocate. He did not agree with Mr. Sidney, that the prizes of the Royal Agricultural Society had done little to stimulate the progress of the implement trade. Mr. Scott complained that the name of Tuxford, who had twice received the Royal Agricultural Society's medal, had been omitted in the paper, whilst the names of several eminent drill makers had also been unnoticed. Although he would not go to the length of saying that he regarded the plough as a doomed implement, yet, having seen its work on clay lands, he considered it one of the most clumsy inventions ever made, and there was an implement—as yet not mentioned—which he thought might well be substituted—the steel digging fork. During the last two years he had made experiments with it upon 200 acres of land, comparing not only the cost of ploughing, dragging, harrowing, and rolling, but also the results of the two operations. The price paid for digging with the fork was about £2 per acre. The land could be dug 10 or 14 inches in depth, as required, and he found the results much more profitable in all crops—especially green crops—than under the ordinary method of tillage, even with twice ploughing.

Mr. William Bennett, while expressing the interest he had derived from the reading of the paper, thought that the author had endeavoured to prove too much. The use of the drill had not been confined to the last 20 years. He had used a drill 40 years ago, and about the same period this implement was in extensive use in Norfolk. Four out of five farmers in that county employed the drill as early as the years 1819-20. He thought the saving by steam threshing had been put at too high a figure, although it was, doubtless, a great improvement, and might be more largely employed with advantage. Under ordinary circumstances he did not think the difference would be more than 6d. or 9d. per quarter. To farmers who were anxious to realise their crops speedily, the steam engine was unquestionably a great boon. He hoped his remarks would not be regarded as in opposition to the use of steam in farming operations, but he thought Mr. Sidney had put the case too strongly. He had used the wooden-breasted plough 45 years ago, and had then gained a prize cup from the Bedfordshire Agricultural Society. With regard to the fork digging mentioned by Mr. Scott, he could only say he should be sorry to do such work at £2 per acre.

Mr. Mechi said, with the steel fork a labourer would earn full wages at that rate of pay.

Mr. Scott added that some of his men earned twenty-four shillings per week by it.

Mr. William Day, as a consumer of bread and meat, and therefore interested in the price of those staple commodities, would be glad to hear from some of the practical gentlemen from the country how it was that, with all the late mechanical and scientific improvements in agriculture, the price of bread and meat had continued so high.

Mr. Durrant Cooper said, he wished to state his experience as a joint proprietor in steam-threshing apparatus, in what was considered at one time the worst part of Yorkshire. The steam-engine and threshing-machine had been employed there with the most satisfactory results. The wheat was threshed at a cost of from 1s. 6d. to 2s. per quarter. Moreover, wheat dressed by the steam-machine always bore the preference, amongst millers, to that threshed by hand labour. At the same time, those machines might not be attended with equal profit on small occupations, and on that point he did not go quite to the extent of Mr. Mechi's opinion.

Mr. Mechi remarked that no farm of 300 acres ought to be without a steam-threshing machine.

Mr. G. H. Ramsay thought that this subject, so ably treated in the paper, had been of great use to the agriculturists; and whether the improvements mentioned dated from 1836 or 1856, was, in his opinion, a matter of small importance. There had been, for some years past, a great and increasing demand for all kinds of agricultural produce; and he thought that Mr. Day was unreasonable in asking that meat should be sold at a less price than it would fetch in the market. If a population was doubled in the course of a century, notwithstanding a vast quantity of hitherto waste land was annually brought under cultivation, he could not understand how the increased demand was to be met. Upon the subject of steam-threshing, gentlemen from the same county did not agree to the saving effected, one placing the cost at 1s. 6d., and the other at 3s. 6d. per quarter. He could do his own threshing at 2s. per quarter, and he considered that an excellent price. There was an association in the north of England, by whom the work was done at 2s. per quarter, and a good dividend was paid upon the capital invested.

The Chairman, in closing the discussion, said he was sure they must all have been interested by the able manner in which Mr. Sidney had treated this subject, and by the manner in which it had been treated by those who had taken part in the discussion upon it. He thought they were open to a great deal of instruction from their grandfathers, and he felt indebted to Mr. Bennett for having shewn them that 40 or 50 years ago people did know something about the plough. No doubt the great improvements effected in the manufacture of that implement had cheapened the cost of production, and although they had passed through four prosperous years for agri-

culture, they would yet require all the economy that the intelligence of agricultural implement makers could bring to bear. Foreigners attended our agricultural exhibitions in large numbers, and were large purchasers. The machines were thus taken abroad to compete with the English farmer. They would, therefore, see the necessity of doing all in their power to improve their own productions. As to the charge brought against the agricultural community by Mr. Day, that the price of meat did not keep pace with the improvements in agriculture, he begged to say that it was not the fault of the farmer that meat was at its present price, but the fault of the consumers themselves, who had increased in a greater ratio. With regard to the criticisms in which Mr. Sidney had indulged, it was some consolation to him, to find that three of the most important machines—which had conferred such great benefits upon English agriculture—viz., the horse hoe, the reaping machine, and the threshing machine, were all the inventions of Scotchmen.

Colonel CHALLONER had great pleasure in proposing a vote of thanks to Mr. Sidney. Had time permitted, there were several points in the paper which he could wish to have touched upon. The great question of the present day in agricultural matters was the advantages of steam ploughing and steam threshing machines. It appeared to him that the great advantage of the application of steam power to matters of that kind, was where farming was carried on upon a very large scale, and where labour was deficient. He did not agree with Mr. Sidney in his disapproval of the plan of giving rewards for the invention of implements of real practical utility. The Royal Agricultural Society, after a great deal of consideration, thought so much of the necessity of endeavouring to apply steam to the cultivation of the soil, that they offered a premium of 500 guineas for an implement to turn over the soil, as nearly as possible, upon the same principle as was effected by the spade in hand-labour, and many such machines had been produced. The Society had been the originators of a vast deal of mechanical talent. They had shown the agricultural machinist the machine that was wanted, and he hoped the time was not far distant when this great agricultural desideratum would be realised.

The vote of thanks was then seconded by Sir JAMES ANDERSON, M.P., and carried unanimously.

Mr. SIDNEY, in reply, said, he had not attempted a history of invention, but a history of trade, which was the most certain evidence of agricultural progress. He had not intended to make an attack on Essex, but he stated an undeniable fact. Within a few weeks he had been hunting in Essex, and had there seen wooden swing ploughs, with a hedgestake spud stilt, turnips broadcasted and drained with shallow open ditches, and farm buildings where the manure was put on a heap to drain into the ponds. He was not going to defend the steam threshing machine against the flail; that question had been decided by the farmers of England against Mr. Baker, for they had purchased thousands of machines, and were purchasing more every day. As to the Council of the Royal Agricultural Society, there could not be the slightest question that the great landlords, of which it was virtually composed, had rendered essential and invaluable services to agriculture by their great exhibitions, and the zeal for agricultural improvement which they had cultivated by precept and example, but an analysis which he had recently made of the prize-sheets of the Royal Agricultural Society for seventeen years, proved that, while a long series of useless toys had been rewarded, such valuable improvements as Bentall's broadshare, Coleman's cultivator, Crosskill's clod-crusher, Chandler's liquid drill, Richmond's chaff cutter, Gardner's root slicer, and others equally important, had been fully established among farmers before they received any reward from the Society. He maintained that the time had come for reserving prizes for great and much-needed inventions or improvements, such as steam-ploughing.

The Secretary announced that on Wednesday evening next, the 16th inst., a paper by Mr. John Underwood, "On the History and Chemistry of Writing, Printing, and Copying Letters, and a new plan of taking Copies of Written and Printed Documents, Maps, Charts, Plans and Drawings," would be read.

Home Correspondence.

APPLICATION OF THE SEWAGE OF TOWNS TO AGRICULTURE.

SIR,—Having lately, in company with Messrs. Moll and Mille, Commissioners from the Minister of Agriculture in France, and some French agriculturists, made a tour to places where the sewage of towns is applied to agricultural production, and visited a number of farms under the liquified manure culture, I am in a position to deal with some serious misrepresentations made by Mons. Barral, a French journalist, the editor of a publication called the *Journal d'Agriculture Pratique*, contained in an anonymous paragraph, extracted from a weekly newspaper, and inserted in the Society's *Journal*, No. 253. As displaying obstructions to science created by objectionable modes, as I deem them, of treating such questions—as well as a matter of justice, I must claim attention to some answers which I think it due to give.

M. Barral puts forth a statement, in relation to incidents of two farms, as affecting the whole principle of culture; the one, a farm at Myer Mill, near Ayr, owned by Mr. P. W. Kennedy, the Manager of the Branch of the Royal Bank of Scotland, and Provost of Ayr; the other, the small farm at Canning-park, occupied by Mr. Andrew Telfer, a merchant, at Ayr, who deals specially in manures.

The paragraph speaks of the "ruined farm" of Myer Mill, and M. Barral states that, "the ruin of Mr. Kennedy, of the liquid manure farm of Myer Mill, Ayrshire, has produced a very unfavourable opinion of the liquid manure system among the farmers." The Mr. Kennedy here mentioned, it is to be presumed, is Mr. James Kennedy, the former manager, a cousin of the owner, who, I was informed, left Myer Mill in consequence of an offer, on highly advantageous terms, of a farm on Sir Robert Peel's estate; and so far from Mr. James Kennedy believing the system to be a failure, he had stipulated for the appliances requisite to carry it out on his new farm. We did not find the new tenant at Myer Mill Farm, but we were informed that, instead of the farm being stopped, as represented, the present occupier was only waiting for the repair of the steam-boiler, and other changes for its conversion from a stock-feeding to a dairy and cheese-making farm, for which the superior quality of the milk attested there, and attested generally at other farms, as being obtained from the produce of liquified culture, would particularly suit it; and specimens of the new cheese were given to us and pronounced to be of high promise.

It was only in the exercise of great courtesy that Mr. Kennedy, the owner, could be prevailed upon to answer inquiries touching in anywise upon representations which he could not but disdain for their want of accuracy, and despise for their ignorance; but he informed the commissioners of the fact, which in itself answers the representation of the ruin of the farm,—that it had been let to the new tenant at double the rent previously paid for it; the improvement, however, comprising new buildings and other works, as well as the new distributary apparatus. Mr. Kennedy further stated, confidently, that if he had to

do the work over again, he would make no material change in it, nor would he restrict the distributary apparatus, even over those portions of the farm possessing falls suitable for the distribution by shedding; for the method by shedding had been tried and found to be too slow, and the expense of steam power, instead of being large, was really small, as part of the entire operations. Moreover, that mode of irrigation confined the operation to grass cultivation, which was a serious loss. An intelligent agriculturist, who held the farm after the first manager, had declared, after a ten years' experience, that he did not see that the farm could be advantageously altered.

It may here be mentioned that on another large farm, —that of Mr. Harvey, near Glasgow,—where the distribution is from tanks on the hill tops, by shedding from pipes as by water meadows, but without any expense of surface formation whatever, the tenant declared that he now believed that he should double the effect of his manures if he were to distribute by the jet, in the manner in use at Mr. Kennedy's farm at Myer Mill; and, on a proper examination, without his declaration, it is clear that he might do so; for whilst by the method of the water meadow the surplus manure runs away into the ditches to great waste, the method of distribution requires four or five times more manual labour or time.

Instead of reducing the application of steam power and machinery, as proposed in the case of applications on a large scale, on account of their supposed expense; instead of returning to a method of distribution which occupies the surface for weeks,—from twelve to fourteen days, with from two to three inches deep of liquid. as I am informed by the engineer who laid out Sir Stafford Northcote's catch-water meadows, referred to as models,—the manager of Lord Essex's farm, for the application of the sewage of Watford, and Mr. Worsley, the owner of the land irrigated by jet with the sewage of Rusholme, expressed the opinion that the present occupation of time in distribution, even by the jet, during hours, might be advantageously abridged, and they would prefer augmenting the application of steam power, on account of its assured economy. Instead of its being true that the operation of the Works at Myer Mill had prevented the application of the new principle being followed elsewhere, the commissioners were invited to see one farm in that part of the country, where new works on the same principle are in progress, and several subsequently completed, and they have received a list of thirty-two new farms where new works have been completed, and got into full operation by Messrs. Young, mechanical engineers, at Ayr, since they executed the Works at Myer Mill.

In respect to that part of the paper in which Mr. Barral gives his own account of Mr. Telfer's verbal description of his farm, which Mr. Barral adduces as showing misrepresentation on the following points, in what he calls the official report of the Board of Health:—

"1. The subterranean irrigation system is only applied to half the farm, consequently the cost per acre," he says, "is just double what the Board of Health report states."

"2. No account is taken in the official report of the enormous application of guano, at the rate of 8 and even 16 cwt. per acre. Thus the estimated profits must be reduced by the cost of the guano, about £486 per annum."

Now, if M. Barral has himself read the document from which he professes to quote, which, for his sake, I must presume to doubt, he cannot but have been aware that he was not quoting from the report of the Board of Health, but from one of eighteen appendices, comprising the accounts and views of his Royal Highness Prince Albert, of M. De Candolle, of Bousingault, an account of the irrigations at Milan, by Count Arrivabene, the estimates and plans of different inspectors, not one of whose differing particulars has he any right to assume. in the absence of a distinct recognition, that the Board adopts more than any other. Incidentally, as illustrating the superior quality of irrigated produce, mention is made that Mr. Telfer obtained two pence per pound more than the current price for his butter, but no estimate is given, nothing is said in the Board's report about his profits, or about the profits of any one else. Whilst in the one account of Mr. Telfer's farm—mis-quoted as the Board's—that of Mr. Lee (for there is another account given of the same farm by the Hon. Dudley Fortescue,) the cost of iron pipes is stated at £2 10s. per acre; in the Board's minutes of information, the cost of "iron pipes and steam power" is stated at £4 4s. per acre,—whilst examples of other plans and charges are given from £3 2s. 6d. to £6 5s. 5d., with different plans, sizes, and lengths, and the prices of pipes, &c., so as to enable any one to form estimates for himself. Indeed, Mr. Lee's paper contains plans and estimates, as well as accounts of different farms and scales of expenditure, such as would correct any mistake made in one item of account of the particular farm selected from the rest, and unwarrantably held forth as if it were one particularly selected, and presented as a general example in respect to the expense of works. Any important error in the account of this particular farm, is due to Mr. Telfer himself, who, I was assured by Mr. Lee, had stated to him, at the time of its publication, that it was in the main correct, and who certainly, in his correspondence with me, never took any exception to it; nor, in the first instance, specified the extensive use of guano or artificial manures, if he did use them extensively at the commencement of his working with the new machinery. It might indeed at that time have been naturally overlooked, for the main question then was not as to the distribution of any one species of manure, but of every species of solid manure, in suspension or in solution in water. The charge against the general Board, couched, by inuendo, against myself, of having ignored the use of guano, and ascribed the whole of the production there to the common farm-yard manure, will be found to be of the same character as the rest of the representations in the paragraph.

If any competent or impartial person will read over the official minutes of information, he will perceive that the main question there treated is, as to the relative economy and efficiency of a new mode of mechanical distribution, in solution or in suspension in water, of solid manures of all sorts, of solid town manures, of solid farm-yard manures, and of guano, as well as diluted urine. By this new machinery, to use the illustration of Mr. P. W. Kennedy, "the land becomes loam, into which we put the raw materials, out of which the crop is manufactured;" and it was shown that it was applicable to almost any species of materials, even to mere sands, of which Mr. Telfer's farm furnished an important example. At page 58 of the Board's minutes, the conditions for the best application of liquified manures, are specified, and it is observed that "farmers who have observed none of these conditions in the application of guano, and have laid it on in bright "windy" weather, have had their manure evaporated by the ship-load, and their money blown away. They have then reported that guano did not answer on their land, and so with other manures. The ordinary effects of guano, Mr. Kennedy states, have been doubled by distribution in solution in water at the right times, by the new distributing apparatus, &c.

In respect to Mr. Telfer's farm, I will call the attention of M. Barral to the following passage, from the statement I made at the Congress at Brussels, and re-published in England, where it could scarcely have escaped the attention of his informants.

"In answer to some general observations of mine on the great advantage the system of liquified manure farming appeared to me to offer under the climate and soil of France, Mr. Telfer, writing to me in May, 1855, says, "I am fully alive to the advantages France possesses over this country in temperature, the most important element in vegetable life. With a moderate temperature all that remains to be supplied is manure and moisture, food for

the plant in suitable form. This the system of pipeage enables you to furnish in exact accordance with the requirements of the plant. I am satisfied liquified manure could be successfully applied to grain crops in such a country as France, whereas here, from the uncertainty of the weather at harvest, it is accompanied with greater risk. Had I been favoured last year with dry weather during the time my wheat crop was ripening, my yield would have been 100 bushels the Scotch acre," ($1\frac{1}{4}$ English), " or upwards of 85 hectolitres the hectare, instead of being confined to a small piece of the field that did not lodge, but on it the average of the field was a high one, 85 bushels. This high average is in some measure to be attributed to the thorough admixture with the soil of the various manures which had been applied in former crops by means of pipes. I am supplying ammonia this season entirely through my pipes, and at one-half the cost I did formerly, as the article can only be used by those who have pipes. I find the supply of manure must be in proportion to your command of moisture, the one being of little use without the other."

"On this I have to observe that whatsoever may be the remaining risk in England in the cultivation of cereals under this method, it is now proved, on various of the new farms to be less than the risk there under the ordinary method. Count Gasparin gives an instance of the production of 70 hectolitres of wheat per hectare in France, but he gives it as—a feat. Lord Kinnaird tells me that he has had as much grown on a farm belonging to him in Scotland, as a feat. In this feat of Mr. Telfer he used, as I understood from him, in addition to his farm-yard manure. a large proportion of guano, and his easy advance is due to the new instrument for its distribution in solution as liquified manure; but in other farms, which I think the most important examples, 40 and 45 bushels are given without any foreign or other liquified solid stable dung or diluted stable urine as manure."

Neither would a statement which I made at a meeting held at the Royal Agricultural Society, on the 15th of April, 1855, have probably escaped the notice of M. Barral's informant. In the course of that reported statement I observed, "I have visited the farms of forward and successful agricultural improvers during the last year and the year before, who have put their farms under tolerably complete distributary apparatus, who were still using guano or other artificial manures, whilst they had near the cattle sheds heaps of decomposing dung, which ought not to have been there but in dilution, and incorporated in the soil, and whose liquid manure tanks were stinking with the escape of the products of decomposition, denoting the waste which is preventible by putting the manure in its right place, *i.e.*, the soil. One eminently successful improver is a guano merchant, and is to be excused for displaying to the farmers a liquified application on his farm of the powerful effect of his commodity. Another farm manager has also excusable prepossessions in favour of special manures, which he has been moved to try. But the opinion, evidence, and the particular examples to which I advert, justify the objection which I make to the addition of any imported stimuli by the managers, whilst the farmyard itself presents, in the unused dung and in the products of decomposition evolved from the stagnant contents of the tank, the demonstration of the presence" (and escape) "of unused or misused manure."

On the testimony of horticulturists practically experienced in the application of liquified manures, I felt justified in applying these observations to such management as that of Myer Mill, by Mr. James Kennedy, as well as to the management of Mr. Telfer's farm, in the condition in which they were on the occasion of previous visits. The fact stated by Mr. Mechi, that the state of the water in distant water courses has denoted the days of his applications of liquid manures, is, I apprehend, a demonstration that he applies it wastefully, and that even he has yet to learn to do justice to the principle by more frequent applications, better adjusted to the absorbent powers of the soil. If Mr. Telfer had intended to make such statements as M. Barral reports, *e.g.*, "the liquid manure is only used to wash in the guano. Mr. Telfer considers that its fertilising powers were very slight;" Mr. Telfer observed, "It is only a vehicle for guano; what there is does no harm, but it is quite insignificant;"—Mr. Telfer would have justified the supposition that he, as the chief salesman of guano, and of the artificial manures used within the district, was exalting the powers of the manures he could sell at the expense of those he could not sell. In accepting and putting forth such testimony, to the effect that the liquified manure of 50 head of cattle was of little or no effect, *presque rien*, when applied to 50 or even to 25 acres, could the editor of the *Journal d'Agriculture Pratique* have been aware of the experience of Belgium and Switzerland as to the powers of such manure? Can he have been aware of the recited experience and expositions of Schwerz, on liquified applications of manure, above all of the expositions of his own great countryman, De Candolle, who was, I believe, the first scientific agriculturist to enunciate the conclusion which I cite in his own terms:—"It is to be desired that the practical use of liquid manure, which serves at one and the same time as manure and for watering, should become more universal and popular in a great part of Europe?"

But Mr. Telfer authenticated by his signature a declaration to the Commissioners (much to the same purport, as I understood it, as his letter above cited), that he held no such conlusion as that attributed to him by M. Barral; and he at the same time stated that the account given of the operations of his farm by Mr. Morton, the editor of the *Agricultural Gazette*, was correct, and authenticated by himself before its publication. Now that account is, on the whole, higher than the one given by Mr. Lee (except in its statement as to the quantity of guano, not then specified by Mr. Telfer), which is the subject of Mr. Barral's attack. The intrinsic ignorance implied in such alleged testimony as that above attributed to Mr. Telfer, is only equalled by that implied in the like reported testimony of the owner and of the occupier of the farm at Rugby—that the excreta of a population of some five thousand persons, when conveyed in water, had very little fertilising power! How greatly the testimony of Mr. Walker, the owner, must have been misrepresented, I showed by the testimony of Mr. Walker's own authentic declaration. What the occupier may have said of the manure, in his position of a buyer, I cannot say, but I have a note of his evidence in respect to the value of the manure for sale to a neighbouring farmer, given to Mr. Alfred Dickens, the Inspector of the General Board of Health, on the occasion of an occasional visit by the President, the Right Hon. W. Cowper—"Mr. Campbell pays Mr. Walker at the rate of four shillings per 9,000 gallons; Mr. W. finding pipes, labour, &c. Mr. Congreve," the present occupier, "stated, that to produce the same results with ordinary manure, as those produced by the sewage," as was understood, for a quantity of some four inches, or less than one-third that applied in most of the greater examples of applications of sewage, "would require about twenty loads of the ordinary muck, the cost of which, and putting in, &c., would be about £10 per acre. Mr. Walker said he thought that about 100,000 gallons per acre cost £2, and he puts that sum against £5, which he estimates as about the cost of an ordinary top-dressing."

To any one whose own state of knowledge, applicable to the particular subject, is so low as to render him incompetent to judge of the intrinsic value of any testimony upon it, and to cause him to be held in doubt by contradictions of any kind from any quarter, I repeat that he may easily determine for himself the value of

all conflicts of testimony, by trial works, which he may at little trouble and expense make for himself on his own farm, or in his own garden, by taking equal quantities of stable manure or any other manure, applying one portion in the solid form in the manner of the ordinary top dressing; by putting the other portion in solution in four or five times its bulk in water, and applying the solution to the land by the watering pot, and following up the growing crop, with food in water, in such quantities, and at such times, as a good gardener may advise. But the increased fertilising power of manures applied in solution or in suspension in water, and at once conveyed amidst the soil, and put in chemical combination with it, or applied as food to the growing plant, I must assume to be a general elementary fact or principle, placed beyond dispute, by a concurrent mass of testimoney from horticulturists, and from agriculturists at home as well as abroad. The new general elementary fact or principle which I have caused to be established, is a mechanical rather than an agricultural principle,—is the cheap as well as rapid means of applying the fertilising power of liquified or diluted manures or simple water; the power of doing almost for shillings, what by the gardener's watering-pot can only be done with the same rapidity, on the same scale, for pounds.

This elementary fact may be, as it is, evaded; but it is beyond the power of any engineer, however eminent, or of commissions, to gainsay it, unless to their eventual disgrace. The other new elementary facts established, are the power of removing sewage or liquid manure, and of applying it to the soil before advanced stages of decomposition arise, and its permanent retention by the soil in chemical combination.

As I stated the other day at the Public Health Section of the meeting, at Birmingham, of the National Association for the Advancement of Social Science, the progress and position of the question, as applicable to the relief of towns, has close analogies to the progress of railway communication. As stated by Charles Knight, "the earliest railway for public traffic in England, was one passing from Merstham to Wandsworth, through Croydon, a small single line on which a miserable team of lean mules or donkeys might be seen crawling at the rate of four miles an hour, with several trucks of stone and lime behind them. It was commenced in 1801, and opened in 1803, and the men of science of that day,—we cannot say that the respectable name of Stephenson was among them" [Stephenson was then a brakesman at Killingworth]—"tested its capabilities, and found that one horse could draw some thirty-five tons at six miles an hour, and then with prophetic wisdom declared that railways could never be worked profitably." Later on, when a locomotive was seen conveying goods at a rate of more than twenty miles an hour, at a cost of three-eighths of a penny, or less than a halfpenny per ton per mile; or, in other words, when the elementary fact was demonstrated of the practicability of public conveyance more than six times quicker and six times cheaper, than the common method, the cry was still the same, in the face of the demonstration, that it would never answer. And no doubt there have been apparent justifications for their prognostications,—but totally independent of the elementary facts,—as in double and treble expenditures, &c., beyond what is now proved might have sufficed. Lord John Russell has stated that it takes a quarter of a century to get a new simple idea into the public mind of England. In a quarter of a century, when the elementary fact or idea of the cheapness of railway conveyance did get into the mercantile mind, and became established and properly considered, and had superseded all mere opinion evidence, the chief direction of opposition,—and that, too, in the guise of superior wisdom,—was to supersede the first successful plan, not by anything more simple, but by something more complex and obviously dearer, as by substituting the performance of the one engine running, by a multitude of engines which were stationary, by rope or chain, or by atmospheric or hydraulic traction.

In respect to the distribution of town and farm-yard manures, and simple water, the elementary mechanical fact has been established of a power of distribution relatively as cheap and as quick as the railroad compared with the common road conveyance; upwards of 100 tons being proved to be distributable within an hour, at a less expense than two shillings, and this elementary fact has been presented in varied demonstrations with engines of different power, chiefly small, all excelling the common method in rapidity and cheapness in distributions at a mile of distance, from a penny to a halfpenny per ton; but in the face of these demonstrations, there are men of scientific position who declared that it could not be worked profitably, that is to say, that it would not answer to do that for pence which is now done for shillings, or to do that in an hour which now requires a day.

The opposition made to the application of this engineering element, to the distribution by jet, on the ground of its expense, reminds me of a story told of the late Duke of Bedford, that having urged upon one of his farmers who was ploughing with four horses in line, that as good work might be done with two horses properly yoked abreast, the farmer boldly denied the fact; on which the duke got off his horse, unyoked the team, dismissed two, attached two abreast to the plough, took it in hand himself, and did good work with it; to which practical demonstration the farmer's answer was, "that it might be all very well for his grace, as a duke, to work in that way, but he, as a farmer, could not afford it." This was a farmer of the old school; but here we have the editor of a scientific agricultural journal accepting a story as a fact, and proclaiming it to Europe, that a farm had been ruined by a plan which saves all the liquid manure previously wasted—had been ruined by works which, at a expense of 10s., effect a distribution of 40,000 gallons per diem, or, with the labour of one man at the engine, and a man and a boy at the hydrants, regularly effect a distribution of upwards of eighteen tons of liquified manure per hour, about a mile distant;—as much as would probably be distributed within the same distance, within the same time, by some hundred of men by the Swiss method of distribution with the *dossier!* His dealing with the established elementary fact, or principle of the fertilising power of such manure, really is of the character of one presented to the notice of the Commissioners, in connexion with the farm of Mr. Harvey, the great dairy keeper, near Glasgow, where the urine from the cow-sheds alone sufficed to raise a very large farm to a degree of fertility exceeding almost all others in the same district, and enabled him to sell the whole of his dung to other farmers, of whom we were informed that, notwithstanding the visible demonstration made from year to year of the fertilising power of the liquid manure, most of the farmers who bought the dung were unaffected by the visible demonstrations, and continue to allow the liquid manure produced on their own farms to continue to run to waste into the ditches and watercourses.

Notwithstanding the imperfections of the first works,—some of which, I must confess, present examples in respect to execution of the like humble grade as that of the first railway example at Croydon,—the primary elementary principles in question have been so far advanced that, as in the case of the early railway progress, the chief efforts in the way of opposition are as respects the town manures to obtain substitutes more complex in principle and more costly in application. Under the new system of tubular drainage, now extensively completed in many, and in progress in some hundred towns, all refuse is at once removed, without stagnation, without deposit, before it can enter into any advanced stage of decomposition, and before noxious emanations can be evolved; and it is demonstrated that, after constant removal from beneath the sites of houses and towns, it may be even more rapidly applied to agricultural

production. In the two working examples of Rugby and Watford, the refuse discharged into the house drains at eight or nine o'clock, will, under ordinary circumstances, be upon the land before ten or eleven o'clock, and not merely upon the land in mechanical suspension, but incorporated in the soil, in effectual chemical combination; not merely deodorised, but disinfected. As in the case of the first lengths of railway traction brought into complete operation,—competent and disinterested persons who duly considered them, would see in them the demonstrations of the most extensive applicability, so in these examples of the application of town refuse to agricultural production, no doubt would be entertained that, by the application of the like means, the whole of the morning's refuse of the metropolis might be put in constant removal at the rate of some three miles per hour, and would be inoffensively incorporated in the soil before the nightfall;—that all the necessary works, internal and external, to achieve this result, might be accomplished considerably within the expense required by the official referee's plan of outfalls, to throw the whole of the refuse of the metropolis into the sea.

But the new elementary facts are far too simple for popular, or even, it would seem, for professional appreciation; and greater complexity, more so called "art and genius," and works of greater expense are required. Instead of discharging the refuse from the houses of the poorer and middle classes, it is sought to retain it in *fosses mobiles inodores*. Failures and nuisances in the course of abandonment in France are re-invented and re-patented in England, and agitation is maintained for their introduction. It being thus proposed that the excreta shall be retained in the houses in a decomposing state, deodorizers and disinfectants are to be used, and every house is to have its chemical manipulations with one of the chemical agents: and the conflict is, which it shall be,—whether peat charcoal, sulphite of zinc, or sulphite of magnesia shall be manufactured on immense scales of expense and profit. In respect, however, to house drains, short lengths, with good falls behind the houses, are too simple and too cheap;—kitchen floors are to be ripped up, the front pavement and road-ways are to be broken through for long lengths of drains with bad falls; prolonged divisions of the drains, which increase friction, are preferred, and, even where tubular branch sewers are adopted, sizes are frequently used for two or three houses which would serve for two or three hundred. In the face of the demonstrations of the complete self-cleansing powers of sewers of sizes and shapes properly adjusted to the flow of the sewerage, such large sizes and rough formations are maintained, so as to increase the friction, retard the flow, occasion deposit, and create extended cesspools. Then there are necessary arrangements for intermittent flushings, besides demands and projects for the extensive use of deodorizers and disinfectants to check and mitigate the products of decomposition; elaborate but unsuccessful trappings to protect houses and streets against their escapes, and calls for the construction of immense ventilating shafts, to lead away and diffuse above and spread about the deleterious vapours which it is proved the simple and less expensive works do not generate. When the manure which has been detained, decomposed, and deteriorated at the expense of the inhabitants, arrives, after storms or flushings, at the outfall, its direct application by quick and economical power, is too ample and far too cheap. It is to be arrested and spread out into large sewer reservoirs, there to be subjected to an expensive chemical treatment, which precipitates a portion to be converted into a solid form; which solidified manure must again be put into water, for the development of such fertilising powers as it may contain, the highest of which are not pretended to contain as much as is thrown away on the original solution. At the meeting of the Health section of the Association for the Advancement of Social Science, I asked a projector who brought forward a plan of this species, had he seen the works tried on the same principle at St. Thomas's, Exeter, which had been abandoned. No, he had not. Had he examined those tried at Croydon and abandoned? No, he had not. Had he examined those nearer, at the works at Leicester, the solidified manure of which had not succeeded; or others on the like plan,—which Mr. Pigott Smith, the surveyor of Birmingham, not inaptly described as an elaborate machinery for obtaining the bran, and throwing away the flour,—a description which a close examination and report by Professor Hofmann, of the College of Chemistry, and other chemists, fully justifies? No; he had not. But he will still persevere, and in despite of the proved elementary principles of success on the one side, and of failures on the other, large capital is invested,—in the instance of Leicester, double that which would have sufficed for a direct application,—in the face of such experience, as that for half a century at Edinburgh, and of the continued letting of inferior applications at £20 and £30 an acre per annum. Agitation is maintained for the depreciation of the principle and practice of liquified applications, and the exaltation of applications of the solidified manufactures, of which it has been repeatedly announced that the records of the Royal Agricultural Society do not furnish one solitary instance of success.

Where these intermediate applications are proposed to be elided, and more direct applications adopted, the evidence of the elementary facts ascertained is still defied. Thus, in respect to the area required, it is now tolerably well ascertained that 100 acres will suffice for the utilisation of the sewage of 500 houses; that for the metropolis, some fifty or sixty thousand acres, about the extent of the Plumstead and the Kentish marshes, would suffice; but one plan demands nine millions of acres, whilst the official referees, more moderate, but still without any justificatory facts, demand one hundred thousand acres. On considerable experience, it is now ascertained that for the complete distributing apparatus, of pipes, hydrants, &c., for the land, leaving it free for arable as well as grass cultivation, an average expense of £5 per acre (or the average expense for permanent works, of one year's ordinary top dressing) will suffice;—that with this apparatus, thirteen or fifteen inches of liquified manure will produce as great an effect as sixty inches thrown on by the old method of submersion;—but in the face of this experience (*v. ante*), the formation of water meadows, at the expense of £12 per acre, is preferred, leading to the conversion of extensive sewer marsh surfaces, with additions of works, leading to an estimated expenditure of no less a sum than £75 per acre.

"It must not be expected," says the Archbishop of Dublin, "that reason will universally make its way. '*Medicamenta*,' says the medical aphorism, '*non agunt in cadaver*.' Those in whom indolence is combined with pride, will be induced by the one to remain in their position, and by the other to fortify it as they can." The exposition of the misdirected interests that stand in the way of science, and actively impede the progress of practical art, could only be made at much length, and I will, in conclusion, only refer to that part of M. Barral's paper wherein he alleges that the "ill repute of the Board of Health in England has especially arisen from the heavy expenses which it has imposed upon towns for the express purpose of applying their sewage to agricultural purposes, the result having rarely (never) answered the promise made by Mr. Chadwick, and that the ruin of Mr. Kennedy, of the liquid manure farm, Myer Mill, &c." Passing by the allegation of the unpopularity of the Board, who received petitions from upwards of two hundred and eighty towns for its intervention, and whose ordinary functions were exercised in the main upon voluntary applications; it is not correct to allege that Mr. Chadwick has pretended to make any personal promises whatsoever, either as to the application of sewage, or of farmyard manures. As to their productive powers, the promises really made were those

contained in the evidence cited, of De Candolle, of Schwerz, and of eminent English agriculturists, of the experience at Milan, and the continued letting of the Edinburgh water meadows at £20 per acre or more. As to the mechanical powers of distribution, the promise made was mainly on undisputed trial works, easily repeatable, and on the cited facts adduced by engineers, who will be found to be of pre-eminent distinction in the comparative closeness of this expenditure to their estimates. The promises put forth on such evidence, of which all might judge for themselves, will be found to have been everywhere realised, in proportion as the evidence itself has been adhered to. Mr. Barral may judge of the sort of hands into which he must have fallen, from the fact that not a single town made any practical application of the kind whatsoever, or was known to have incurred any expenses of the kind, or was called upon or could be compelled by the Board to do so, the Act having given to it no compulsory powers for the purpose. It was, however, a matter of extensive request from local authorities that such powers should be provided to be exercised by the Board in their behalf for the removal of obstructions which still prevail against those who have mastered the subject. "Minutes of information" were prepared and issued for the guidance of voluntary efforts, such as those made by the Earl of Essex for the application of the sewage of Watford, and those by Mr. Walker for the application of the sewage of Rusholme.

I feel justified in calling upon M. Barral to name his authority for the statements above made, for I have no doubt that the source will be found befitting the feelings of exultation manifested at the obstruction or frustration of labours directed to the prevention or mitigation of some of the heaviest inflictions on mankind.

I am, &c.,
EDWIN CHADWICK.

THE SMOKE QUESTION.

Sir,—Not having had an opportunity of replying to the various observations made upon my paper on Wednesday evening last, I shall feel obliged by your inserting the following in the next week's *Journal* of the Society. I may congratulate the meeting that my paper elicited so much valuable information from the various speakers, several of whom rather misapprehended the drift of my facts and arguments; by the former both in glass furnaces and several steam-engine boilers, viz., three at the Phœnix gas works, and one at the Falcon glass works, it has been proved beyond the question of a doubt, that coke, taken fresh and dry from the gas retorts to the furnaces, has given rather more heating power at the rate of one chaldron, than one ton of small Newcastle coal, without smoke or injury to the bars or boilers.

Mr. Greaves's experience of the advantages of gas coke being inferior to mine, arises most probably from his coke not having been fresh, perhaps wet and somewhat broken by exposure and conveyance in open barges, which, I have reason to believe, would deteriorate gas coke to the extent of 15 to 20 per cent. Mr. Fothergill's remarks upon coke being inferior to coal for locomotives, refer probably to anthracite coal (or coal of that class), which is but a more close (less porous) and aggregated form of carbon than coke. Coke is usually bought (and ought to be bought) by measure. It is, however, a good check as to strength, to have a test by weight also, as, in case of its proving much less in weight than 13 cwt. per chaldron, an increased quantity ought to be allowed to the consumer. I had great difficulty in persuading Mr. Frederick Pellatt to try coke in such large proportions as 19 of coke to one of coal, but complete success attended his first week's trial, and he has never since been disappointed. If Mr. Quick and Messrs. Doulton would double their proportion, viz., two-thirds of coke, I have no doubt of its success, as the one-third bituminous coal would, I believe, have sufficient carrying power. If Mr. Stevens had noticed that my paper in no case advocates the use of coke without some small coal, his question would have been unnecessary. It is sufficient to observe that where long flues in boilers require carrying fuel, more small coal should be added to the coke. With respect to his "dissent from my general conclusion," he seems to have omitted in his calculation the gas, which very greatly exceeds in value the fuel used for its generation, and which would have made all the difference in his Dr. and Cr. account, which, however, in any case, would be no disparagement to my facts, viz., that when manufacturers can get cheap and fresh gas coke in their locality, it may be used in large or lesser proportions with economy, &c. Mr. Patrick Buchan, then present, would have stated, had he the opportunity, what he has since communicated to me by letter, that at the Crewden Iron Works, of which he is manager, in Ireland, "The coal is highly carbonaceous, burns with a yellow smoke, and contains 70 per cent of coke. Practically, we get that return from our coking ovens. For the sake of economy in carriage, we coke it and throw away its gaseous and other parts. We should use 3 tons of coal in making a ton of iron; the equivalent would be 40 to 45 hundredweight of coke, but, bearing out your observation, it really amounts to 35 to 38 cwt." So that it appears that coke for smelting iron on a large scale has been about 13 cwt., or one chaldron, against one ton of bituminous small coal, practically confirming my experiments on a large scale, for raising steam and melting glass in ordinary furnaces.

I am no enemy to the use of machinery or inventions for preventing the smoke of bituminous coal, which should be used where coke or anthracite cannot be bought cheaply. I mentioned that Messrs. Doulton have a steam-engine boiler of almost Cornish dimensions, with a fire-place in the centre, like a marine boiler, with two dampers, one for the ingress and another for the egress of the air, with ample throat, and still more ample chimney, the thick door of the furnace being perforated with numerous small holes, which separate and heat the entering air, but which, being afterwards closed by outside shutters, when the gases were burnt off from a charge of coal, the air entered only through the bars below. The heat was greater than that of a Cornish furnace, and was working ordinary coal smokelessly with a consumption only of half a ton for 10 hours daily, though the engine did the work of from 25 to 30 horses.

For house purposes the celebrated Dr. Arnott has a close stove, burning coke day and night with remarkable economy, his estimate being about one ton per annum; he has also open stoves, partly for coke and coals, which give a good heat at about two tons per annum, say one ton of each, and could be kept burning, were it necessary, all the year through smokelessly.

Should legislation ever be extended to private houses, the Doctor's principle and inventions for adapting the supply of air to the consumption of the fuel would be more largely adopted.

When small coal only was used as formerly in a glass furnace, the smoke was intensely dense, even with careful stoking, and when a charge was put on, such an immense quantity of gas and smoke was produced as for a short time checked the heat of the furnace and lowered its temperature, (as ammonia water is stated to do when converted into steam within gas retorts). The large portion of the coke used (with only a 20th portion or more of coals) checks the heat infinitely less than coal when thrown on, and no skill of the stoker is comparatively necessary, as he could hardly cause smoke with coke fuel if he desired it. Mr. Hyde Clarke is mistaken in supposing the small coal was *stale* and badly stored, as it always came from the London coal-merchants as soon as sifted, and was at once placed before the furnace for use. It appears that he (Mr. Clarke) tried coke in his

establishment, for raising steam, without success; so did Mr. F. Pellatt, and did not succeed till he enlarged his furnace, &c., to the dimensions adopted by Mr. Innes, at the Phœnix Gas Works.—I am, &c.,

APSLEY PELLATT.

Staines, Dec. 5, 1857.

DRAINAGE AND UTILIZATION OF SEWAGE.

Sir,—Last year I submitted to the Sewage Commissioners certain suggestions. Moderate towns, of about fifty thousand inhabitants, could be drained by one underground sewer, and its branches. London, containing, say, three millions of people, should be subdivided into l ongitudinal sections, at right angles with the river, so that every section may contain about 50,000 people, as near as the undulations of ground and deviations of present channels would admit. About sixty channels would thus open into the Thames, north and south, each being discharged separately by its own individual motive power. I propose that every separate section of 50,000 inhabitants, shall disharge its own sewage into 10 or 20 tanks, say of 1,000 tons each, their tops to be on a line with the lowest level of the present outfall. Twenty such galvanized iron or timber vessels could be easily worked, *per se*, by a few common labourers. Sixty distinct tanks, of 20 tons capacity each, will take in a total average of about 1,200 tons, or about 212,800 gallons.

This will give time for the rapid precipitants to purify the water, which is to be shot off clear into the river, at an average pressure of 20ft. at low water, and of 30 feet at high tides. The sediment could be pressed out again for use.

Deluges of rain storms could, in great part, be conveyed riverwards, along many street or surface channels, and in certain localities a few existing drains could be maintained clear, for the transit of storm floods only.

It is by the variety of gases generated in the manufacture of the phosphates and ammoniates, that motive power is gained; it is by the action of these gases in close tanks that smells are abated. Bi-carbonate of magnesia is produced in the tanks, or in separate vesssels, and these materials, acids and carbonates, phosphates and ammoniates, form heavy and nearly insoluble triple phosphates, made to subside in the vats so rapidly that the clear and scentless water may be discharged into the Thames after 6 hours' subsidence of its silt. In ordinary cases, steam is the best motive force, but it contributes no *quality* to liquids. It cannot work well except by the intervention of machinery. But one or other of the gases here mentioned constitutes its own piston, to drive water down in vats and up in shafts, and to discharge pure water into rivers, whilst collecting sediment, equal to guano, on the bottoms of the vats. In some cases it is better to mingle the chemical materials and their results among liquid manures or sewage, and to force them constantly, without subsidence or delay, to rural districts for irrigation.

I am, &c., JAMES MURRAY.

MEETINGS FOR THE ENSUING WEEK.

Mon. Architects, 8.
Geographical, 8½. I. Mr. Galton, "On the Exploration of Arid Countries." II. Mr. Moffatt, "Journey in the Bushman and Namaqua Land, South Africa." III. Latest Accounts of the fate of Dr. Vogel, Central Africa. IV. M. Brun-Rollet, "On the White Nile."

Tues. Civil Engineers, 8. Annual General Meeting.
Pathological, 8.
Statistical, 8.

Wed. London Inst., 7.
Society of Arts, 8. Mr. John Underwood, "On the History and Chemistry of Writing, Printing, and Copying Letters, and a new plan of taking Copies of Written and Printed Documents, Maps, Charts, Plans, and Drawings."
Geological, 8. I. Mr. J. Prestwich, "Note on the Boring through the Chalk at Harwich." II. Mr. R. Godwin-Austen, "On a Granitic Boulder out of the Chalk at Croydon, and on the Extraneous Rock Fragments found in the Chalk." III. Mr. C. J. F. Bunbury, "On the genus *Neuropteris*, from the Coal Measures."

Thurs. Philosophical Club, 5½.
Numismatic, 7.
Antiquaries, 8.
Chemical, 8. Rev. J. G. Macvicar, "On a new Maximum and Minimum Thermometer."
Linnæan, 8. I. Mr. Sclater, "On the Fauna of New Guinea." II. M. Fée, "On the nomenclature of the genus *Buffonia*." III. Mr. F. Muller, "Report on the Botany of the North Australian Expedition."
Philological, 8.
Royal, 8½.

Sat. Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November* 27.]

Dated 3rd November, 1857.

2787. Stanislas Hoga, Charlotte-street, Fitzroy-square—Improvements in electric telegraphs.

Dated 11th November, 1857.

2845. Peter Madden, 1, Russell-place, Dublin—Improvements in kilns for drying corn, malt, or other granular substances, part of these improvements being applicable to the screening or sifting of such substances during the process of drying.

2847. Otto William Wahl, 27, Leadenhall-street—Improvements in manufacturing farinaceous products from potatoes. (A communication.)

2851. Joshua Williams, Neath, Glamorganshire—An improvement in coupling and connecting carriages on railways.

Dated 12th November, 1857.

2853. James Stevenson, jun., Glasgow—Improvements in lighting apartments and passages.

2855. Stanley Webster, Bolton-le-Moors—Certain improvements in machinery or apparatus for tanning.

2857. George Tomlinson Bousfield, Loughborough-park, Brixton—Improvements in castors. (A communication.)

Dated 13th November, 1857.

2861. Anguish Honour Augustus Durant, Conservative Club, St. James's—An improved apparatus for husking and winnowing castor seeds for the purpose of obtaining the larger quantity and a purer kind of oil therefrom when pressed than heretofore with the outer skin or cuticle on.

Dated 14th November, 1857.

2863. George Haseltine, Washington, U.S.—Improvements in machinery for the manufacture of small metallic chains. (A communication.)

2865. James Henry Bennett, 8, Vambrugh-place, Leith—Improved compound safety valves.

2867. Alfred Vincent Newton, 66, Chancery-lane—Improvements in apparatus for retarding and stopping the progress of railway trains. (A communication.)

2869. John Fereday, Wolverhampton—An improved form of steam engine.

Dated 16th November, 1857.

2871. Jean Baptiste Donas, 36, Rue de l'Echiquier—A new optical instrument, which he calls "physioscop."

2873. John Edward Hodges, Leicester—Improvements in the manufacture of looped fabrics.

2875. James Taylor, Birkenhead—Improvements in dredging machines, which improvements are also applicable to other purposes.

Dated 17th November, 1857.

2877. Thomas Field, Spring place, Kentish-town—A new method or mode of, and appliances for, submerging submarine telegraph cables.

2881. William Pidding, Southwark-bridge-road—Improved manufactures and improvements in the manufacture of piled fabrics, or of mosaic or tesselated textile and other fabrics, and improvements in some of the machinery or apparatus necessary to produce them, also the application of certain existing or known machinery or apparatus for their production.

2883. Solomon P. Smith, Cresent, New York, U.S.—Constructing iron wheels for railway carriages and similar purposes.

2885. Richard Archibald Brooman, 166, Fleet-street—Improvements in gas burners. (A communication.)

2887. Edward Daniel Johnson, Wilmington-square—An improvement in the construction of fuzee watches.

INVENTION WITH COMPLETE SPECIFCATIONS FILED.

2901. Henry Davis Pochin and James Woolley, Manchester—Improvements in the manufacture of gum or dextrine from amylaceous substances.—19th November, 1857.

[*From Gazette, Dec.* 4, 1857.]

Dated 15th October, 1857.

2641. Henry Angelo Ludovico Negretti, and Joseph Warren Zambra, Hatton-garden—Improvements in producing graduated scales, and other signs, letters, numerals, characters, and pictorial representations, upon porcelain and other ceramic and enamelled materials, which improvements are applicable to the graduated scales of meteorological and other philosophical instruments.

Dated 19th October, 1857.

2676. Benjamin Garvey, Asland, New York, U.S.—Improvements in apparatus for determining position and direction on land and sea.

Dated 2nd November, 1857.

2780. Nelson Matthews, Dodworth, near Barnsley, York—Improvements in pumps.

2782. Mathieu François Isoord, Paris—Improvements in producing heat and light.

Dated 3rd November, 1857.

2788. James Mallison, jun., Bolton-le-Moors—Certain improvements in 'gassing' yar n and textile fabrics, and in the apparatus connected therewith.

2790. William Joseph Curtis, 1, Crown-court, Old Broad-street—Improvements in machinery used for slotting, boring and surfacing.

2792. Henry Kinsman Sweet, Northumberland-street, Strand—Improvements in photographic portraits and pictures. (A communication.)

2796. John Seithen, Earl-street—Improvements in machinery for cutting cork.

Dated 4th November, 1857.

2798. William Fothergill Batho, and Eugene Moritz Bauer, Salford, near Manchester—Improvements in machinery or apparatus for drilling and boring metals, and also for cutting key ways and cotter holes.

2800. James Murphy, Newport, Monmouthshire—Improvements in the permanent way of railways.

2802. Charles Edward Amos, the Grove, Southwark—An improved arrangement of steam machinery for driving rotary pumps.

2804. James Houghton, Kilburn—An improvement in braces.

Dated 5th November, 1857.

2808. Henry Bessemer, Queen-street-place, New Cannon-stret—Improvements in treating iron ores.

2810. Henry Beinhauer, Deutz, near Cologne—Improved machinery for drawing or extracting water from mines, wells, pits, or other deep places by means of suction.

2812. Heinrich Hochstaetter, Darmstadt—An improved machine for the manufacture of matches.

2814. Henry Robinson Palmer, Lambeth—An improved stamping and endorsing machine.

Dated 6th November, 1857.

2816. Robert Ker Aitchison, New North-street—An improved break, applicable to wheeled carriages.

2818. William Anderton, Ince-within-Mackerfield, Lancashire—New railway chairs.

2820. William Macnab, Greenock—Improvements in vessels propelled by screw or other similar propellers.

Dated 7th November, 1857.

2822. John Fordred, Stoke Newington—Improvements in treating and purifying water.

2824. John Adams, Queen's-road, Dalston—Improvements in revolver fire-arms.

Dated 9th November, 1857.

2826. Peter Brotherhood, Chippenham—Improvements in boilers and furnaces.

2828. Daniel Stothard, Lambeth, Joseph Jones, Southwark, David Jonas and Benjamin Woolf Jonas, Spitalfields—An improved ship's block.

2830. John Pinker, Pease-street, Hull—Improvements in governors for marine steam-engines.

2832. Alexander Parkes, Bath-row, Holloway-head, Birmingham—Improvements in the manufacture of nails.

2834. William Jekin Elwin, Dartford, Kent—Improvements in night-lights.

Dated 10th November, 1857.

2838. Charles Eugene Lecointe, Paris—A new mode for advertising.

2840. Alexander Parkes, Bath-row, Holloway Head, Birmingham—Improvements in the manufacture of tubes and cylinders of copper and alloys of copper.

2842. Josiah Harrington, 9, Glo'ster-place, Brixton-road—Improvements in apparatus for pointing pencils or marking instruments.

Dated 11th November, 1857.

2844. Henry Thompson and Samuel Thompson, Regent-street—Improvements in the construction of piano-fortes.

2846. John Richard Cochrane, Glasgow—Improvements in the treatment or manufacture of ornamental fabrics.

2848. Isaac Taylor, Stanford Rivers—Improvements in apparatus used in printing calico and other fabrics when cylinders are employed.

2850. Albert John Davies, 29, George-street, Hanover-square—A protective sandal for bathers, which may also be adapted as an auxiliary for swimmers.

Dated 12th November, 1857.

2852. Ebenezer Coleman, Dudley, Worcester—An improvement in lathes for turning bolts, screws, and other small articles in metal.

2854. Françoise Honorine Felicie Bertrand de Sivray, Paris—Certain improvements in the construction of bedsteads.

2856. William Picking, Lambeth—An improved method of, and apparatus for feeding steam-boilers with water.

Dated 13th November, 1857.

2858. William James Gifford, 23, New Millman-street—Improvements in the making, reefing, and working of sails, and in the construction and arrangement of masts, spars, and rigging, for ships and boats.

2860. William John Macquorn Rankine, University of Glasgow—Improvements in fan-blowers.

2862. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the treating and smelting of iron ores, and in obtaining products therefrom.

Dated 14th November, 1857.

2864. George Printy Wheeler, Abbingall, near Mitcheldean, Gloucestershire—Improvements in the preparation of materials for the manufacture of paper pulp or half stuff.

2866. John Macintosh, North Bank, Regent's-park—An improvement in preparing telegraphic wire, which is coated with gutta percha, in order to render it more capable of resisting heat, and in laying down telegraph wires in the sea.

2868. Michael Henry, 77, Fleet-street—Improvements in electric and galvanic conductors, and in the mode of, and machinery for, apparatus for manufacturing the same. (A communication.)

Dated 18th November, 1857.

2889. John Tinker, Staly-bridge, Cheshire—An improved sizing matter.

2891. Frederick Ayckbourn, 4, Lyon's-inn, Strand—Improvements in bird cages.

2893. Adolphe Ambroise Salomon-Cohen, Paris—Improvements in machinery or apparatus to be employed in the manufacture of drain pipes and other like articles from plastic materials.

2895. Major Booth, Manchester, and James Farmer, Salford—Improvements in machinery or apparatus for stiffening, drying, and finishing cotten, linnen, woollen, and other woven fabrics.

Dated 19th November, 1857.

2899. Marc Antoine François Mennons, 4, South-street, Finsbury—An improved washing and drying apparatus. (A communication.)

2903. Seth Gill and Henry Newton, Liverpool—Improvements in obtaining stereoscopic pictures.

2905. William Clay, Liverpool—Improvements in the points, switches, and crossings of the permanent way of railways.

2909. John Clarke, Shiffnal—Improvements in the construction of shafts and poles for cabs, omnibuses, and other vehicles.

2911. John Cope, Birmingham,—Improvements in buttons.

2915. Clement Lawrence West, 25, Rupert-street, Haymarket—Improvements in window sashes. (A communication.)

Dated 20th November, 1857.

2917. Joseph Denton, Pendleton, near Manchester—Improvements in looms.

2921. Henry Bessemer, Queen-street-place, New Cannon-street—Improvements in the manufacture of iron and steel.

Dated 21st November, 1857.

2923. Thomas Glover, Upper Chadwell-street, Myddleton-square, and Alexander Bain, Fetter-lane, Holborn—Improvements in eletric telegraphs.

2924. Gerd Jacob Benson, Christian-street, St. George's in-the-East—An improvement in the manufacture of moulded sugar.

2927. Jean Marie Auguste Eugene Fabart, Paris—Improvements in looms for wearving.

Dated 23rd November, 1857.

2929. Samuel Riley, 1A, Victoria-terrace, Victoria-street, Manchester—An improvement in the preparation of chocolate and cocoa.

WEEKLY LIST OF PATENTS SEALED.

December 4th.

1572. Victor Blumberg.
1588. James Morris.
1590. Thomas George Shaw.
1594. Edward Hirst Hudson.
1597. Edward Edwards.
1626. Maxwell Miller.
1628. Thomas Humphrey Roberts.
1632. Etienne Lemoine.
1734. Lambert Cowell.
2034. Julius Schonemann.

December 8th.

1601. Donald Bethune.
1604. John Bickford.
1613. Rich. Archibald Brooman
1618. George Mumby.
1623. James Brown.
1629. George Sampson, Joseph Sampson, & Elijah Ledger.
1638. Daniel Joseph Daly.
1645. Joseph Whitworth.
1651. Edward Brasier.
1663. Etienne Cominal.
1664. Thomas Moreton Jones.
1667. Thomas Heaton.
1672. Frederick Levick, junior.
1718. John Dunnell Garrett.
1984. John Henry Johnson.

Patents on which the Stamp Duty of £50 has been Paid.

December 1st.

2557. George Ferguson Wilson & John Chase Craddock.

December 2nd.

2594. Nathaniel Johnston.

December 3rd.

2624. Samuel Fisher.

December 5th.

2571. James Edward McConnell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4035	Dec. 8.	The Chain Pocket to prevent picking and cutting...	Stopford Jones........................	75, High Holborn.

Journal of the Society of Arts.

FRIDAY, DECEMBER 18, 1857.

EXAMINATIONS.

The following resolutions have been received from the Institutional Association of Lancashire and Cheshire:—

Resolved unanimously,—

"That the Council of the Institutional Association, in addition to their own Examinations, undertake to conduct the preliminary local Examinations of the Society of Arts, and also to supervise the working of the papers for the Society's Examinations."

"That the Council of the Institutional Association strongly recommend the Council of the Society of Arts to allow the preliminary Examination for 1858, in Lancashire and Cheshire, to be held in Easter week, six weeks before Whitsuntide; the report to be furnished to the Council within one week of the days of Examination, or not less than five weeks before Whitsuntide, and for the following reasons specially applicable to 1858:—First. That the pupils in the evening classes, in our Institutions, may have sufficient notice to prepare themselves for Examination; and, secondly, because the present depressed state of trade in the manufacturing districts materially retards the progress and efficiency of the classes in the Institutions in Union in Lancashire and Cheshire."

FIFTH ORDINARY MEETING.

Wednesday, Dec. 16, 1857.

The Fifth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 16th inst., Mr. Thomas Winkworth, V.P., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Blackwood, James	Letheby, Henry, M.D.
Blaine, Delabere Roberton	Milnes, William
Haines, Henry	Nightingale, Charles

The Paper read was:

ON THE HISTORY AND CHEMISTRY OF WRITING, PRINTING, AND COPYING INKS, AND A NEW PLAN OF TAKING MANIFOLD COPIES OF WRITTEN AND PRINTED DOCUMENTS, MAPS, CHARTS, PLANS, AND DRAWINGS.

By John Underwood.

Prior to the invention of printing, when all the business of the world was carried on in writing, and its literature and science deposited in manuscript, the manufacture of a black and durable ink was evidently not only of the first importance, but was recognized as such; and that we have seriously retrograded in this, as well as in many other branches of the Arts cannot be denied; in proof of which we have only to refer to the manuscripts in our possession, when we find that those from the 5th to the 12th century, notwithstanding their greater age, are in a far better state of preservation than those of the last four centuries; for while the writing in the former is always perfect, and, in many cases, as black as if it had just been written, that in the latter is often really not legible. The grounds for this disparity arise partly from the spirit of competition, so rife in the present day, which is always looking after the cheapest article that can be obtained, and also from the rapidity with which it is thought necessary to carry on all business transactions, and which does not allow time for the use of the comparatively thick ink of ancient times; but when we think of the enormous amount of property that depends, for its proper transmission, upon the permanence and durability of the ink used in the preparation of title-deeds, wills, &c., I consider that no expense of time or money ought to weigh with us in so preparing them that they shall be unalterable by either age or the skilled arts of those who may desire fraudulently to tamper with them.

Many experiments have been made with a view to discover the composition of the ink of the ancients, and the results arrived at from analysis are apparently opposed to each other. The first chemist who devoted his attention to such analysis was Dr. Lewis, to whom we are indebted for much of our present knowledge upon this subject, and who has left us an article upon it full of valuable research in the "Philosophical Commerce of Arts," published in 1763. From his analysis, he comes to the conclusion that the ink of the ancients consisted entirely of fine lamp black or charcoal, held in suspension by some mucilaginous fluid; which opinion was afterwards supported by the experiments of Mr. Thomas Astle, author of a work "On the Origin and Progress of Writing," published about the year 1780; but this view does not at all accord with the results of experiments made by Sir Charles Blagden, which were embodied in a paper read before the Royal Society, in 1787. He states that he had been led to inquiry on this subject by his friend Thomas Astle, who supplied him with several manuscripts dated from the 9th to the 15th century inclusive, some of which were still very black, while others varied from pale yellow to different shades of dark yellowish brown. All the documents he experimented upon, with one exception, agree in the general result, showing that the ink employed in these manuscripts, was of the same nature as that in present use. The letters turned of a reddish or yellowish brown on the application of alkalies; were rendered pale, and at length obliterated, by the dilute mineral acids, and the drop of acid liquor which had extracted a letter changed to a dark blue or green on the addition of a solution of prussiate of potash; moreover, the letters were changed to a deeper tinge by the infusion of galls. Hence he asserts that it was evident one of the ingredients employed was iron, which there was no reason to doubt was joined with vitriolic acid; while the colour of the more perfect manuscripts, which in some was a deep black and in others a purplish black, together with the restitution of that colour, in those which had lost it, by the infusion of galls, sufficiently proves that another of the ingredients was an astringent matter. No trace of a black pigment of any sort was discovered, the drop of acid which had completely extracted a letter appearing of an uniform pale ferruginous colour, without an atom of black powder or other extraneous matter floating in it. One of the specimens sent to him by Mr. Astle, proved very different from the rest. It was said to be a MS. of the 15th century, and the letters were those of a full engrossing hand, angular, without any fine strokes, broad, and very black, on which none of the above reagents produced any considerable effect; most of them rather seemed to make the letters blacker, probably by cleaning the surface, and the acid, after being rubbed strongly on the letters, did not strike any deeper tinge on testing with the prussiate of potash. Nothing had any sensible effect, he found, towards obliterating these letters, except what also took off part of the surface of the vellum, when small rolls, as of a dirty matter, were to be perceived. It is, therefore, unquestionable, he continues to say, that no iron was used in this ink, and, from its resistance to the chemical solvents, as well as a certain dotted appearance in the letters when examined

closely, and, in some places, a slight degree of gloss, there was litttle doubt, in his opinion, that they were formed with a composition of black, sooty, or carbonaceous powder and oil, probably something like our present printer's ink, and, from these results, he was led to suspect that these marks were actually printed. It is said that a subsequent examination proved this to be part of a printed book.

From these experiments, and with the belief on his mind that this latter document must have been printed, he concludes that ancient inks had no carbon in them, and that their greater durability depended upon the better preparation of the parchment or paper upon which the writing was made. The fact that the tinge of colour produced by the action of prussiate of potash seemed less deep than that produced by its action upon inks of more modern date, led him, also, to the belief that there was a less quantity of iron, in proportion to the astringent matter, than is used in the present day. So generally did he believe iron to have been used in the inks of ancient times, that he recommends for general adoption the use of prussiate of potash, combined with a mineral acid for reproducing writings which have been effaced by age. Indeed, in support of the view that iron was generally used in the manufacture of these inks, we find Camparius, who wrote on the subject of inks at Venice, in 1619, recommending the use of an infusion of galls in white wine for the restoration of faded MSS.

Though at first sight the experiments of Dr. Lewis and Mr. Astle seem at variance with those of Sir Charles Blagden, yet, I think, they will both serve to support a view of my own, that in the ink of the earlier centuries of the Christian era, no uniform receipt was adopted, but while in many cases it was purely carbonaceous, yet it generally consisted of a black dye, very similar to our ink, with the further addition of a large quantity of lamp black, or finely-powdered charcoal. It will be found that neither Lewis nor Astle give us the method of chemical analysis which they adopted, and, therefore, we may suppose that with the preconceived notion that the ink was simply carbonaceous matter held in suspension in some mucilaginous fluid, when their experiments proved the presence of pure carbon in the writing, they did not sufficiently prosecute their researches to discover the iron, but decided at once that it was simply what they had previously supposed. Relative to the experiments of Blagden, it must be borne in mind that we do not know on how many specimens he experimented, but we do know that none of them were of earlier date than the ninth century, and, although in some he did not find any trace of carbon, yet in one of them its presence was most clearly proved, and the tests for iron he does not say produced no effects upon it, but no considerable effects, and with regard to his suspicion that this latter was a printed document, I cannot conceive that he was correct, because, if so, it must have shown the indentation of the type; moreover, printing was hardly so far advanced at that time as to be such a perfect fac-simile of writing, as to deceive a person of Dr. Blagden's knowledge and research throughout the series of microscopic investigations which his experiments required. It must be remembered that it was not the appearance of the writing, but the chemical difference of the ink that first led him to suspect that the words were printed and not written.

From experiments I have made with inks composed of black dye and the lightest lamp-black, I find the great obstacle to their use is the difficulty of keeping the carbon in suspension, and knowing when it is so, for, if not frequently agitated, the carbon settles down, and, the colour of the ink not depending upon it, you continue your writing, little thinking that it is quite destitute of the principle upon which its permanence depends. I conceive it to be possible that in many of the MSS. of former days the writing might be destitute of carbon through the carelessness of the writer in not seeing that the ink was shaken, and I think we may fairly conclude that such was the case with those MSS. in which Dr. Blagden could discover no trace of carbon. Again, if Dr. Lewis and Mr. Astle were correct in saying that all the ink of the earlier ages was composed of lamp-black which never changes its appearance, how are we to account for the various tints of colour which those deeds exhibited. Mr. Astle refers to the following curious case, showing the various changes of tints which the ink of one period has undergone, and it does not seem to have occurred to him that this case militates most strongly against his own opinion. He tells us that he had in his possession a long roll of parchment, at the head of which was a letter that had been carried over the greatest part of England by two devout monks, requesting prayers for Lucia de Vere, Countess of Oxford, a pious lady, who died in 1199. The roll consisted of many skins of parchment sewn together, all of which, except the first, contained certificates from the different religious houses that the two monks had visited them, and that they had ordered prayers to be offered for the Countess, and had entered her name in their bead rolls. He says, "it is observable time hath had very different effects on the various inks with which these certificates were written. Some are as black and fresh as if written yesterday, while others are changed brown and some are of a yellow hue."

Now, I am inclined most strongly to contend that if those signatures had been made with a purely carbonaceous ink, they could not have changed to a yellow hue, while I do think it, nevertheless, highly probable that in all, or most of them, carbon had been used, although in some cases it might have settled to the bottom, and not been taken up by the pen. Some of the MSS. at the British Museum give remarkable support to my opinion, for on closely inspecting them it will be seen that while some words and letters, even parts of letters, have retained their full depth of blackness, yet the remaining parts of these letters are of a yellowish colour, in some places with black particles in them, and in others without a trace of any black matter, and so regularly does this remarkable change occur throughout some of the MSS., that by noticing where the blackness commences and runs off to pale yellow, you can almost point out every place where the pen has been freshly dipped into the ink, showing beyond a doubt that such writing was done with an iron ink that had free carbon in it, but, through want of care in keeping it agitated, there was not sufficient carbon for it to be distributed through all the letters. The statements of Pliny and Dioscorides also confirm me in my view. Pliny discoursed on so many subjects, of which he had no practical knowledge, that his remarks are often difficult to understand, yet both he and Dioscorides plainly tell us that the Romans and Greeks used inks made otherwise than from lamp-black and charcoal, and, as Dr. Lewis and Mr. Astle, as well as the authors of articles in many of the encyclopediæ, tell us, that both these ancient writers support their view, that the only inks used in former times were carbonaceous, I will here give the literal translation of their remarks on the subject.

We read in Pliny's natural history, "Atramentum, too, must be reckoned among the artificial colours, although it is derived in two ways from the earth. For sometimes it is found exuding from the earth, like brine of salt pits, while at others an earth itself, of a sulphurous colour, is sought for the purpose. Painters, too, have been known to go so far as to dig up half-charred bones from the sepulchres for this purpose; all these plans, however, are new-fangled and troublesome, for this substance may be prepared in numerous ways from the soot that is yielded by the combustion of resin or pitch, so much so, indeed, that manufactories have been built on the principle of not allowing an escape of the smoke evolved by the process. The most esteemed black, however, that is made in this way, is prepared from the wood of the torch pine. It is adulterated by mixing it with the ordinary soot from furnaces and baths, a substance which

is also employed for the purpose of writing. Others again, calcine dried wine lees, and assure us that if the wine was originally of good quality from which the colour is made, it will bear comparison with that of Indicum.

"Polygnotus and Micon, the most celebrated painters from Athens, made their black from grape husks, and called it Triginon. Apelles invented a method of preparing it from burnt ivory, the name given to it being Elephanterion. We have Indicum, also, a substance imported from India, the composition of which is at present unknown to me. Dyers, too, prepare an atramentum from the black inflorescence which adheres to the brazen dye pans. It is made also from the logs of torch pine burnt to charcoal, and pounded in a mortar. The Sepia, too, have a wonderful property of secreting a black fluid, but from this liquid no colour is prepared. The preparation of every kind of atramentum, is completed by exposure to the sun. The black for writing having an admixture of gum, and that for colouring walls an admixture of glue. Black pigment that has been dissolved in vinegar, is not easily effaced by washing."

Dioscorides says, "The ink with which we write, is composed of the smoke collected from lamps. With a pound of gum they mix three ounces of black. By another process branches or pieces of the torch pine are burnt till they become charcoal, when they are extinguished, then pounded in a mortar, and mixed with glue. These make an ink not unpleasant. A third mode is also taken, that of mixing certain proportions of painter's black, pounded charcoal, glue, and what is termed the flowers of brass, (that is the flosculent substance that forms on the surface of melted copper cooled by water)."

Now, although I have sought to show that in many cases the ink of the ancients was composed of a combination of black dye and lamp-black, yet, we know that in some cases it was simply lamp-black mixed with some viscid substance, as gum water or oil. For instance, we find in the MSS. in the Royal Library at Portici, that the letters are blacker than the papyri upon which they are written, though this is perfectly charred; and thus we know that vitriol could not have been employed in the composition of the ink which was used upon them, or the great heat to which they were exposed would have turned the writing to a yellow tint, by evaporating the acid and leaving the iron in a state of oxyde or common iron rust. Besides, the delicate nature of the papyrus would not have borne the corrosive nature of a vitriolic ink, which would have penetrated through it, as may frequently be observed in later manuscripts written on parchment, a far less delicate substance than the papyrus. These papyri manuscripts were evidently written with an ink made of oil and lamp-black, which must have been very thick, and was probably used with a brush, and any doubts as to its composition were set at rest by the discovery, at Herculaneum, of an inkstand with a small quantity of ink in it, which, upon examination, proved to be merely a thick rich oil mixed with lamp-black. The lamp-black was ground up with the oil as painters' colours are now done, and by remembering this we can understand the meaning of Demosthenes when, in a speech of his, he taunts his great rival, Æschines, for having been compelled in his youth, through poverty, to sweep the school, sponge the benches, and grind the ink. This description of ink was also, in some cases, in use in the 7th century, which we learn from a description given by Isidorus, of Seville, as to the nature of its manufacture. But the difference of views regarding the composition of these ancient inks has plainly arisen from the idea that all must have been made by some uniform receipt, which was no more probable than that it should be the case in the present day.

From the fact that there appears less change of colour in the documents written prior to the 10th century, I conclude that while in many cases the very early inks were purely carbonaceous, great care being taken in the use of them, yet, that as the art of dyeing became better understood, so the mixture of black dyes with carbon gradually came into use, till at last the trouble attending that made with carbon led gradually to its being less and less adopted, and it was at length entirely discarded, and the ink made simply with the sulphate of iron and gum combined with an astringent, such as galls or logwood. A substitute for ink was obtained by the Africans from the dark fluid which the Sepia or cuttle-fish has the property of ejecting to conceal its retreat when pursued by an enemy. From Persius, when describing the apparatus of the indolent student, using the word sepia for writing, it is probable that though not generally in use amongst the Romans, it was occasionally employed.

Besides black, the ancients used many different colours. Thus, we find the Sacrum Encaustum, a purple ink, the composition of which was kept a profound secret, was employed for signing documents by the Roman emperors, to whose use it was exclusively reserved; and, by an edict of Leo the Great, it was forbidden, under pain of death, to possess, use or even endeavour to obtain it from the vigilant officers in whose custody it was preserved. This edict was in force from A.D. 470 to 1452, except that in the 12th century the privilege of using it was extended to the members of the Imperial Family, and, in some cases, to the great officers of state. Green ink was especially reserved for the signatures of the guardians of the Greek emperors while their wards were minors.

Since the inferiority of modern ink, compared with the ancient, has become known, several parties have directed their attention to its improvement, but I regret to say with as yet very little result. Those only whose researches on this point are really worthy of much attention are Dr. Lewis, published in his work already referred to, and those of Rebaucourt, published in the 12th vol. of the French Annals of Chemistry; but, unfortunately, they arrive at very different conclusions.

Dr. Lewis considers the rapid decay of many modern inks to arise from a deficiency in the quantity of galls, for, these being perishable, he conceives that the amount which gives the deepest colour at first may be insufficient to maintain it afterwards, and says the great art of making inks is to have a superabundance of astringent matter, so as to counteract the tendency of the iron to oxidation, which is the cause of the ink turning brown and afterwards to a yellow hue, and he recommends that the galls be finely powdered.

Rebaucourt, on the other hand, tells us that none of the principles should be in excess. "For," he says, "if there be more galls than the iron requires, the remainder will be nearly in the state of a decoction of galls, subject to change by becoming mouldy, and undergoing an alteration in the writing which will destroy its legibility much more completely than the change undergone by ink containing too small a proportion of galls; while, on the other hand, if there be a deficiency of them, part only of the salt of iron is decomposed, and the remaining portion will, by exposure, become oxidised and change its colour." He recommends bruising the galls, and not pounding them, and proposes, in addition to the iron, to use the sulphate of copper; but this, though Pliny and Dioscorides tell us copper was used in former times, has great practical objections in modern days, because, in using steel pens, the metal immediately becomes coated with copper, and the acid, set free, soon corrodes them, and they become brittle and useless, while with quills, the knife used in making them is in like manner covered with copper, and the acid, acting on the steel edge, causes it to require constant sharpening.

But I am convinced there is more to be considered in connection with the permanence of our written documents than merely the composition of the ink which is used upon them, and that there is much truth in the opinion of Sir Charles Blagden, that the permanence of ancient writings greatly arose from the quality of the

paper or vellum upon which they were written. The tannic acid formerly retained to a considerable extent in the paper made from linen rags is entirely destroyed by the bleaching processes to which both the linen and the paper are subjected in modern days; and the rolling of our paper, while it brings up the highly glazed surface, so much admired since the introduction of steel pens, yet leaves the ink upon the surface so exposed to the action of the air as to cause it to fade far more rapidly than when used on the rough paper of olden times into which it soaked, and the iron, combining with the tannic acid present, would throw down a black precipitate into the very pores of the paper, which time, though it might change its tints, could not entirely efface.

The same principle we shall see applied to the permanence of ancient writings on vellum. If we look into the method of its preparation, we shall find that it underwent much the same tedious process by which we prepare leather, and in the course of which tannic acid was largely imparted to it. The cause of the deep brown colour of old vellum arises more from its process of manufacture than from the effect of age, as is generally supposed. But to attempt to introduce unbleached paper made of linen rags, and with the same surface as formerly, would be useless, as while in colour it would not suit the taste of the present day, its surface would be very inconvenient for rapid writing with steel pens.

We must, therefore, see if it is not possible so to prepare our paper hat without perceptibly altering its colour and surface, it may possess the quality of retaining the writing as permanently as the paper or parchment of former ages.

Dr. Lewis tried preparing paper with gallic acid, and found that the writing upon it was unchanged after many years, while that done on unprepared paper, at the same time, and exposed equally to the action of the light and air, had entirely faded; and it was afterwards suggested, in the Monthly Review of the *Philosophical Transactions* for 1787, when noticing the paper of Sir Charles Blagden, that a greater permanence might be given to our documents by washing the paper or parchment, previously to writing on it, with a weak mixture of prussic acid and water, or a solution of prussiate of potash, which, without injuring the material, would cause a thin film of Prussian blue to be formed wherever the ink came in contact with it.

I prefer preparing the paper, after it is finished and sized, by soaking each sheet in a solution of the neutral chromate of potash, and then slightly glazing it by rolling, and writing on paper so prepared with an ink made with galls, iron, and logwood.

In the manufacture of this and all ink, the quality of the water used is of far more importance than is generally supposed, for it will be found that if to a decoction of galls we add a few drops of sulphate of iron, it soon mixes with the liquor, and turns it uniformly of a bluish black colour; but if the minutest quantity of an alkaline salt be present, too small to be discovered by any common test, or if the water be in the least degree putrid, the colour will be of a purplish red. Thus, if the decoction be made with rain-water caught in clean glass or earthen vessels as it descends, it turns a bluish black on the addition of the sulphate of iron, but if collected from the tops of buildings, it turns a purplish-red with the same test; and though both the blue-black and purplish-red liquors deepen to a black by evaporation, yet, as we find these liquors respectively, upon dilution, show their blue-black or purplish-red tinge, I conceive that to obtain the best and purest ink, nothing but distilled water should be used.

The next point of importance is the purchase of the galls, which should be the rough blue Aleppo, as they contain more gallic and tannic acids than the inferior sorts, and these should be bruised fine, though not powdered. As the inferior, or white galls, are often dyed blue by dishonest traders, the ink manufacturer should make himself thoroughly acquainted with the different sorts, that he may not be imposed upon.

Having, then, carefully chosen the galls, we treat them with distilled water for a few hours, till they are quite soft, and then let the decoction stand for three or four days, when the clear liquid is strained off, and to it is added some of the best gum Senegal. When this is dissolved, we throw into it a quantity of clean iron filings, or several coils of fine iron wire, and agitate several times a day, till the liquid is turned of a deep black. We then draw it off from its sediment, and dissolve in it some pure extract of logwood. In the course of the operation of the liquid upon the iron, considerable effervescence takes place, which is caused by the decomposition of the water, the hydrogen escaping, and the oxygen forming with the iron an oxide, which the gallic acid in the solution dissolves. We prefer this process to that in which sulphate of iron is used, because in the latter the gallic acid, combining with the iron, leaves free sulphuric acid in the ink, which corrodes pens, paper, and parchment, and even destroys the metal inkstands into which it may be put. In using our ink on the prepared paper, the logwood being in the state of extract, combines with the neutral chromate of potash, and throws down into the very pores of the paper a black precipitate, which, when dry, is perfectly proof against most chemical re-agents. Thus we obtain an ink which, while it is jet black at the time of use, is sufficiently limpid to flow freely in the pen, leaves no surface on the writing, does not become mouldy for a very long time, and is, when used on the prepared paper, literally indelible. Although I cannot, of course, speak positively of the effects of time, yet I think, seeing that the application of chlorine makes no change on it, and that the black precipitate is formed in the texture of the paper, away from all action of the air, we may conclude that time will have as little effect as the chemical re-agents.

A new and important quality for writing inks was introduced by the indefatigable James Watt, in 1780, who, in that year, took out a patent for copying letters by pressure. The great objection to all copying inks has, hitherto, been that their copying properties depending on the ink not drying quickly, and on leaving a considerable quantity of surface on the writing, they could only be used on documents that were to be copied at once, and even these, after a few hours, lost all their copying properties. But the ink made as I suggest, if used on unprepared paper, which dries quickly and leaves no surface on the writing, may at any time after be copied on thin paper prepared with the neutral chromate of potash, and these duplicates as well as the original, when once dry are as proof against chemical re-agents as if the ink had been used on the prepared writing paper. Instead of keeping two inks in the office, we propose to have only one, and to write all letters on unprepared paper, taking a copy of them; while all deeds and other paper documents should be written on the prepared paper, which we also make up into account books, and thus we have our papers, books, and letters, all alike proof against the probable effects of time, or any endeavour wilfully to tamper with them.

The attention of myself and partner was called (last March) by the Executive Government of this country, to a requirement for the more rapid and effectual transaction of their business, and which we afterwards found to exist as extensively in the commercial world. Your Society being aware of the want, had, unknown to us, offered a premium, some two or three years back, for the discovery of some expedient to supply this deficiency, requesting the invention of some plan for rapidly taking many copies of written documents. At first, I looked upon the number of copies required by the government as an insurmountable difficulty, but being much urged by them to make experiments, and remembering that we had overcome the difficulties of making printing inks copyable, to which I shall shortly refer, I resolved to try what could be done.

I made, as you may suppose, an immense number of experiments without success, but at last the idea occurred to me, that by preparing the ink I wrote with, and the paper, with different chemicals having a strong affinity for each other, and which should throw down coloured precipitates, or by chemical reaction change colour wherever they came in contact, I might instead of one take many copies of a document at the same time, and after I had tried many chemicals I found my theory to be correct. The process which gave me most copies was by preparing the thin paper with the neutral chromate of potash, and writing with a strong solution of extract of logwood. Many experiments were required to discover the right strength of the solution of neutral chromate of potash with which the paper is to be prepared, because if I used much of it I could only take one or two copies, as the whole of the extract of logwood would be acted upon by the quantity of the chemical salt in the first sheet or two, therefore to get many copies it is necessary so to reduce the quantity, that while there is enough to have a chemical affinity for the extract, and to change colour wherever it is attracted, it shall not be enough to neutralise the extract until the desired number of copies are taken, and therefore, instead of having paper prepared with the different quantities of the salt, according to the number of copies required, which would have tended to much confusion in all offices of business, we thought it best to have one standard for the paper, and though we would only keep one ink for letter-writing and general purposes, yet we make different qualities of this manifold copying fluid. We have three of these, our No. 1 is the ink formerly noticed as useful for both copying and book purposes, and from which two copies may be taken; our No. 2 has no galls or iron, but is a solution of pure extract of logwood so carefully prepared that exposure to the air in its liquid state shall not have any effect on it, although otherwise it would change in a few months, and from which six or eight copies may be taken at the same time. Another we call No. 3, which is the same, only containing more extract of logwood, and which gives twenty to thirty copies, even more if the writing is allowed thoroughly to dry before attempting to copy.

We have also produced an Indian ink on the same principle, which, when used in the preparation of architectural plans, maps, &c., will give one or more clear copies of even the finest lines, and I had hoped to have had specimens of this class of work for your inspection, but the short time I have had for preparation must be my apology for the omission. The only point to be observed in the taking of such copies, is that as they are done to a scale, they must be kept pressed in close contact with the original, till they are perfectly dry, because if not they will shrink in drying, and the scale be spoilt. While speaking of copying such plans, I may state what, I believe, has never before appeared in print, or been made public, that the ingenious Watt, who invented the plan of copying letters, turned his attention to this point also, and, instead of the ordinary China or Indian ink, used lamp-black rubbed up with the finest and oldest sherry wine, and from plans so made took off a copy on damp paper. From this, which, of course, was reversed, he could take many copies, by letting a boy overrun each of the lines with a mixture of lamp-black and sherry, and after each time of its being so overrun he could take 4 or 6 copies on damp paper. But though the process is adopted by one or two engineering houses in the present day, it is very troublesome, and unless very many copies are needed, it has always been found easier to take tracings. But in all architect's and engineer's offices we believe that our process will be adopted and save an immense deal of time and labour.

Relative to printing ink, your time requires that my remarks be comparatively brief. In examining the earliest printed works, one particularly notices, that while the ink used in the first stages of block-printing was of a very inferior sort, yet that which was used in the first works printed from moveable types, was far superior to that in use towards the end of the last and beginning of the present century. The former still retain a depth, brilliancy, and richness of colour, both in the letter-press and illuminated capitals, apparently as perfect as the day they were printed, while in the latter the ink is brown, withered-looking, and destitute of all clear, distinct, and brilliant appearance.

Within the last few years, however, great improvement has been made in this branch of art, and the best inks of the present day, equal, if not excel those of Caxton and the early printers. For these improvements we are greatly indebted to the chemical knowledge brought to bear upon this branch of manufacture by the Messrs. Flemmings, of Leith, and as they carried off the prize medals for printing inks at both the New York and Paris Exhibitions, I have consulted them, and would here acknowledge their kindness in fully explaining to me the most important points in the manufacture of really good printing ink.

We will first consider the necessary qualifications for it, and then see how best to attain these.

1st. It must distribute freely and easily, and work sharp and clean.

2nd. It must not have too great tenacity for the type, but have a much greater affinity for the paper, and so come off freely upon it.

3rdly. It must dry almost immediately on the paper but not dry at all on the type or rollers; this is a great desideratum especially for newspapers; this drying should be so rapid, that the sheets on being delivered from the machine, will allow the thumb nail to be drawn swiftly over the surface of the newly printed matter without smearing; and though this constant drying on the paper and never drying on the roller or type seems a contradiction and absurdity, yet it is one of the easiest points to be obtained if the manufacturer has any chemical knowledge, and if he is destitute of this it will be in vain for him to attempt to perfect the ink in this respect.

4th. It should be literally proof against the effects of time and chemical re-agents, and never change its colour.

To attain these objects, great experience and care are required in the purchase of the raw materials. Of one of these, linseed, there are many varieties, the Baltic, Black Sea, and East Indian, each yielding oil very materially different, the one kind giving by pressure a thin limpid oil, another a thick mucilaginous oil, which produce very different results under the same application of temperature. The ink-maker having, then, tried his seed previous to purchase, to see that it yields the best oil, must be careful in its mode of crushing, and should only use the oil which comes from the first crushing, because the increase of pressure, after the first oil has been expressed, or the method of steaming the seed and crushing again, gives an additional quantity of fatty matter, which spoils the ink, and which, when present in large quantities, cannot be effectually extracted.

The oil is now clarified from the fatty matters, which will come away, even with the first pressing, and the pure oil is then boiled with great care, regulating the temperature with thermometers, and when in a proper state, the best pale yellow soap is added, to give it consistency. During the boiling, the dryers are added with great care, the proportion varying with the strength of the varnish required. The soap should be previously tested, and the ingredients known. The boiled oil, with these additions, becomes a varnish. In the making of ink for some of the finer descriptions of book-work, palm oil and cocoa-nut oil are valuable additions.

The next point is the manufacture of the blacks, which is a far more scientific operation than one would at first imagine. The finest naptha only, very carefully rectified, should be used, and on burning it the application of oxygen must be regulated to the combustion, otherwise the sudden expansion of the gases with limited

vent would cause a serious explosion, and care is requisite, not only for the safety but for the quality of the blacks, as, if you have not the right quantity of oxygen. the blacks will have more or less of a brown tinge and be very inferior in quality. The empyreumatic oil must now be burnt off, but the secret of making good blacks, which only practice and chemical knowledge will give, is to have as little of this oil present as possible, so that the more experienced manufacturers have far less to get rid of than others. The black, if of a sufficiently deep and rich colour, is now to be ground up carefully with the varnish, which completes the manufacture of the ink, and thus made, it can never turn of a brown colour. But most black requires to be mixed with blue to give it depth of colour, and the blue being fugitive, will, after a time, fade and leave the printing of a brown tint.

Relative to this blue, I would advise the manufacturer to see that his prussiate of potash, nitro-muriate of iron, and acids, are chemically pure, and to use leaden or enamel boilers, instead of the iron ones which they too generally employ. These should be heated by steam passing through leaden or enamelled tubes, as the brightness of the colour depends entirely on chemical purity. Ink made upon this plan, while doubtless the best for book purposes, does not answer for many of the requirements of commerce, and some of the railway companies and large mercantile firms have long been anxious to obtain an ink capable of having copies taken from it by the ordinary copying press. This difficulty we have, at least, got over, by using a deep-coloured varnish, which will freely dissolve in water, instead of the oily one just described, with which we grind our black, or, if we desire more than one duplicate, using a chemical in it such as logwood, and taking our copies on the prepared copying paper, regulating the proportions of logwood to the number of copies required. These copies, with the original, being based on the same principles as our plan of taking duplicates of written documents, are, like them, proof against chemical re-agents, or the probable effects of time.

I had proposed to have explained how, by varying the chemicals used, the same principles may be carried out to take manifold coloured copies of drawings, paintings, &c., but time forbids. I trust, however, I have succeeded in stirring up inquiry on this subject, and in showing you that it is possible to have our writings as lasting as those of ancient days, and that our plan of taking multiplied copies of written and printed documents is very simple, and of no small literary and commercial value.

DISCUSSION.

The Chairman said that it now became his duty to invite discussion on the subject opened up by the paper of Mr. Underwood, which was one of great commercial and economic importance, as well to the professional and literary world as to merchants, bankers, and traders. The statement which they had heard, and in which was traced the history of the art of writing and of the materials employed, from the earliest times, through the middle ages, when the chief scribes were monks and friars, down to our own times, was replete with interest, and did credit to the research of the author of the paper. The Society was favoured that evening with the attendance of many gentlemen who, from their scientific and professional knowledge were eminently competent to discuss the subject. His friend Mr. Deputy Lott, for instance, was not only a solicitor, and therefore interested in the success of Mr. Underwood's invention, but, being an active member of the Antiquarian Society, he was always alive to the progress of antiquarian research, and the citizens of London were largely indebted to him for the preservation of many important specimens of ancient architecture. He begged therefore to invite Mr. Lott and other gentlemen to join in the discussion.

Mr. Deputy Lott said the importance of this subject could scarcely be overrated. He felt an interest in it, because six or seven years ago, when he had the honour of a seat in the Council of the Society, he induced his colleagues to offer a premium for a process of copying manuscripts superior to any that was then in use. As a lawyer he felt it to be a matter of immense importance, and, notwithstanding what had been stated by the author of the paper, he was still of opinion that, up to the present time, the inventions that had been brought out were far from producing results so satisfactory as he desired. As far as he was aware, there were only two principles which had been practically carried out in the copying processes hitherto used; one of them had been discussed by Mr. Underwood, and he (Mr. Lott), could not but hope that the process described was an improvement on what had hitherto been done, Still, however, it was too often found in practice—whether from the defect of the ink or the paper he could not say—that the copy was minus half the original, or that in the lapse of three or four years the document was not in a state to be produced in a court of justice as an authentic copy. It was of the greatest importance in his own profession that documents should be capable of verification beyond all dispute, but as far as he was acquainted with what had been accomplished up to this time, he was sorry to say, the objections he had stated had not been removed. The other mode of copying was that known as the manifold writer, and this he thought by no means satisfactory, and the writing with the style, was much objected to. With reference to the mode of copying introduced by Mr. Underwood the results certainly appeared, judging from the specimens exhibited, fairly successful. Still he (Mr. Lott) thought much remained to be done in that direction. The specimen which he had examined was somewhat imperfect, and appeared to be fading; but the scientific investigations which had been made into the question would probably ultimately lead to these defects being obviated. The author of the paper had dwelt upon the superiority of the inks used in former times. In illustration of that he would mention that he had seen in Durham Cathedral a copy of the Scriptures transcribed by the Venerable Bede, in which the ink used must have been of the very best description, inasmuch as at this distant period the writing was perfect, and the ink a beautiful black. Some years ago he laid upon the table of the Antiquarian Society a grant from the crown, signed by Queen Katherine as regent of the kingdom, during the temporary absence of Henry VIII. at the Field of the Cloth of Gold. It was the most beautiful specimen of writing he had ever seen, and the ink was a perfect black. There was another method of copying to which he would advert, in which the sun was the agent—he alluded to photography; having seen wonderful reproductions of the title pages of books as well as MSS., he thought that its application might be extended to more useful and practical purposes. If this agent could be brought into general use it would prove a very great desideratum to the members of his own profession, as he believed, by that means, a perfect copy of a MS. could be secured.

Mr. Charles May said, this was a subject which had occupied much of his attention for many years. In the early transaction of the Society, there was to be seen a copy of the specification of James Watt, for an ink for copying purposes, and the mode of preparation was described. The paper upon which the copy was taken was prepared with a weak solution of galls. He had seen copies of MSS. in the possession of the present firm of James Watt and Co., which had been in existence for upwards of 70 years, and which, although they had lost their pristine blackness, were nevertheless perfectly legible, owing to the quantity of oxyde of iron deposited upon the paper by the ink employed. He (Mr. May) was inclined to believe that no preparation of vegetable acids, in combina-

tion with iron, would for any great length of time retain its blackness, so long as paper bleached with chlorine was used. It was to this circumstance that he chiefly attributed the marked difference which was observable between the state of preservation of the colour of ink in ancient and modern MSS., rather than to any special difference in the ingredients of the ink itself. With reference to the periods of time at which written documents could be copied, he would mention that for some years he used in his business transactions Arnold's ink, and he could obtain a distinct copy from that three weeks after it was written. It was not a pleasant coloured ink in the first using, being very dull, but it afterwards became a good black. With a little management three or four copies could be taken. He was rather surprised that Mr. Underwood had not referred to the use of indigo in inks. Indigo was capable of preparation for such purposes, and the blue inks of the present day, he believed, consisted of indigo, partly deoxydised, so as to become soluble with an admixture of a small proportion of gallic acid and iron. This had the effect of producing a black colour after some time, and from that description of ink he thought several copies could be taken. With reference to the use of logwood, he very much doubted whether any preparation of this substance would be permanent. It was a most beautiful dye, being the chief ingredient in the dyeing of beaver hats, but it was invariably found that exposure to sea air turned them brown, and he had great doubts as to the propriety of using vegetable matter as the basis of an ink in which permanence of colour was a consideration, especially when employed on paper bleached with chlorine, which he believed could not be effectually got rid of by any amount of washing. The subject was one of great importance, and he agreed with Mr. Lott as to the great desirability of securing copies of documents which could be authenticated in courts of justice. He believed that much of the fading of documents copied by the ordinary process was caused by want of attention on the part of the clerks entrusted with the work. The copies were not taken so well as might be done even with the present appliances. The great object to be attained in all copying processes was an uniform dampness, without a surcharge of water in the paper. He would mention that inks which through age had become of a yellow tint, might be restored to blackness by the use of gallic acid; but this fact was frequently observable,—that the iron held in solution in the ink penetrated the fibres of the paper, and distributed itself beyond the line described by the pen; therefore, if the copy was taken upon paper too much damped (and perhaps the book being shut up damp), the iron constituent of the ink travelled out of its line, and when such writing was restored by the use of gallic acid, much confusion was the result.

Mr. CORNELIUS WALFORD remarked upon the carelessness with which copies of letters, &c., were at present taken. He believed, with ordinary precautions, the present process would be found to be all that was required.

Mr. STEPHENS, as a manufacturer of inks, and having extensively experimented on this subject, would refer to the use of chromate of potash in the preparation of paper, as referred to by Mr. Underwood. Some years ago, he (Mr. Stephens) introduced a marking ink, the preparation for which upon linen consisted of neutral chromate of potash. It had been found necessary that the chromate should be removed by washing after the linen was marked, and in such cases the results had been satisfactory; but, having exported a quantity of his marking ink to America, he had received a demand for compensation for linen destroyed through the use of his marking ink. The fact was, that, in the instance referred to, the chromate had not been washed out after marking. The result was the destruction of that portion of the linen to which the chromate had been applied. Mr. Stephens proceeded to state his experience in the use of indigo as a constituent of writing ink, the indigo being chemically prepared so as to render it more soluble, and the results of experiments, both as to moisture and exposure to sea air, had proved the durability of that description of ink. Ink with a vegetable basis had a tendency to decay, which was apparent even when it was kept in bottles. He thought ink made with prussiate of iron was more permanent. When first used, the writing was of a pale colour, which, upon withdrawal from the light, became more intense. Mr. Stephens mentioned the results of several experiments with this material, and observed that although prejudice against coloured inks had gone to such an extent that an American judge refused to recognize documents written in blue ink, yet he hoped such an objection would not be allowed to operate against that which had been found to be of practical utility.

Mr. PEARSALL, without wishing in the least degree to detract from the merits of any invention, would state that, in his own experience, he had found that blue ink was obliterated from the accidental spilling of water over a sheet written upon with it. If that had been the experience of American judges, he could account for their objection to that description of ink.

Mr. STEPHENS remarked that this would not be the case with documents which had been written for any length of time.

Mr. RUDOLPH APPEL, the inventor of the anastatic and Appelotype processes, stated, that having for twenty-eight years been engaged in transferring printed and written documents of all kinds, and in multiplying copies of them, he might fairly be presumed to know something of the subject then under discussion. About thirteen years since he exhibited to the members of the Society of Arts his anastatic process, when the chairman and various members of the Society wrote their signatures and some sentences, which were transferred, and very many copies worked therefrom within ten minutes, or thereabouts, in each case; and he further stated, that the anastatic process, unlike Mr. Underwood's, was capable of producing any number of perfect copies with a very small amount of labour, occupying only a few minutes in transferring, when the original had been recently written. He was able to reproduce drawings, maps, engineering and architectural plans, with the same facility as common writing, and he had succeeded in reproducing the finest impressions from engraved copper-plates, which had been printed from 50 to 70 years. Mr. Appel instanced the reproduction of the great Austrian maps of Russia and Turkey, occupying an area of about 60 square feet; these he was employed by the English government to reproduce and print at the beginning of the Russian war, and he then delivered fifty perfect copies of each of these great maps within a fortnight. The anastatic process was daily employed at Aldershot and other similar establishments, for the circulation of general orders and official instructions, as well as in the Privy Council Office and other government departments. He thought Mr. Underwood's process was only applicable for producing a small number of copies; certainly, if the vegetable ink made according to Mr. Underwood's method, was found in practice to be permanent, there was no doubt it would be a great improvement, but from his (Mr. Appel's) experience in the manufacture of inks, he was unable to agree with the author of the paper in the conclusions to which he had arrived; still he thought there were many purposes to which Mr. Underwood's process might be applicable.

Mr. VAUGHAN PRANCE begged to ask what had been the results of the application of Mr. Underwood's plan to the purposes of railway companies, such as the copying of way-bills, &c.

Mr. LAWRENCE wished to ask the lecturer whether he used the ordinary press for copying by his process, and whether the copying ink would serve for ordinary writing, as the copying ink in ordinary use was not adapted for general purposes.

Mr. UNDERWOOD replied in the affirmative.

The Chairman remarked that as the author of the paper had very properly said that the material on which to write was a very important element of durability, he might mention from his own experience, as one of the Court of the Weavers' Company, the oldest of all the City Companies (the corporation of London not excepted), that they possessed a charter granted to them in the 12th century by Henry II. (in which reference was made to one previously granted by his great grandfather William the Conqueror), the writing of which was apparently as perfect in all respects as when first produced. He might also incidentally mention that it possessed a merit which professional gentlemen, and especially law-reformers and law-makers, would appreciate, viz., distinctness and brevity. The provisions of the charter had never been disputed, and yet the document itself was compressed within dimensions not exceeding those of the palm of his hand; would that the same could be said of modern charters.

Mr. Varley could confirm the statement made as to the destructive action of chlorine used for bleaching paper. He had seen instances in which the writing was nearly obliterated through that cause. The best way of preserving documents that he was aware of was by the perfect exclusion of atmospheric air.

The Chairman then proposed a vote of thanks to Mr. Underwood for his paper, which was unanimously passed.

Mr. Underwood, in returning thanks, said he could assure those who expressed fears as to the permanence of the copies taken from a logwood ink, that the neutral chromate precipitate was not fugitive, as was that made with iron; and that the firm which he represented had in their possession copies taken nine months ago, which, instead of having faded, were of a more intense black than when freshly taken. He had tried soaking them in solutions of chloride of lime, oxalic acid, and dilute sulphuric acid, without being able to efface the writing. Relative to the remarks made by Mr. Stephens, as to the probability of the neutral chromate of potash destroying the paper in the course of time, he believed that if it was used in the concentrated form necessary for marking linen it might have that effect, but the very weak solution he found it necessary to employ if he desired many copies of a document, and which was also used in the same dilute state for the preparation of the indelible writing paper, had rather a contrary effect, and the largest houses in the stationery trade agreed with him in believing that the paper was much improved in durability by the process of preparation, and the copies he had by him, though done on much thinner copying paper than usual, showed no tendency to decay, and would bear rough handling better than many on stouter paper which was unprepared. He had not been able to give the time he wished to the peculiarly important part of this invention, viz., the great facility with which any person might take twenty or thirty copies of a written document in a short time. For the purposes of rapidly transmitting police intelligence it was most valuable, as any policeman who happened to be in the station when the information arrived, could strike off 17 or 20 copies in ten minutes ready for circulation to other stations. Railway and Steam Navigation Companies acknowledged it would be of great service to them, for it not only enabled them to copy the printing, ruling, and writing of their large way-bills, invoices, etc., but the "memorandum notes," frequently sent from station to station, might not only be copied previously to being issued, but, having been endorsed with a short reply, both question and answer could be copied, and even a third copy might be taken when this came back to the station from which it was orignally sent, the intervals of time, however great, between the taking of these copies making no difference. Bankers and merchants, also, were adopting it with great success, for the taking of many copies of advice letters, foreign invoices, &c., and as this might be done by any ordinary office boy, a great pecuniary saving was effected.

The paper was illustrated by specimens exhibited by Messrs. Underwood and Burt, the patentees of the process, showing copies of large printed and ruled Railway Invoices, Steam Navigation Companies' Manifest Sheets, Forms of Letters, and other documents; besides some 40 or 50 clean copies taken from their different writing inks, as well as specimens of writing on prepared paper, in which the characters had been attempted to be obliterated by oxalic acid, dilute sulphuric acid, and chloride of lime, none of them having been rendered illegible.

The Secretary announced that the next meeting would be held on Wednesday, the 13th January, 1858, when a paper by Mr. J. Bailey Denton, "On the Advantage of a Daily Register of the Rain-fall throughout the United Kingdom, and the best means of obtaining it," would be read.

THE FOOD GRAINS OF INDIA.

By Dr. J. H. Gilbert.

As the Chairman directed the discussion on the recent admirable paper of Dr. Watson, in the first instance, to the questions more particularly affecting India herself, and there seemed to be no opportunity for discussing the subject in its chemical and dietetic aspects after he had himself spoken upon them, perhaps it may be well to make one or two observations in this form.

But, first, a word or two on the question of the import of Indian grains and pulses into this country. It seemed to be generally admitted that the ravages of the weevil in Indian wheat proved a very great obstacle to its extensive import, though, from the examination, in the Rothamsted laboratory, of some Indian wheat sent to this country, as well as from the information obtained by Dr. Watson on that head, it would appear probable that, if uninjured, these wheats would be extremely valuable in admixture, when, as too frequently is the case, large quantities of our own home-produced grains are badly matured, or got in in bad condition. Wheats which serve this purpose, are, however, generally open to the objection mentioned—that of being very difficult to grind with our stones; otherwise, from their composition, we should expect them to fetch much better relative prices than they generally do. Dr. Watson properly observed that the samples of Indian wheat examined contained less water than the average of our home-grown grain. But this is the case with most imported wheats: for they are generally ripened in hotter summers than our own; nor could they be transported, were they not, either naturally or by special management, rendered drier than the average of our own.

Several of the speakers seemed to think that some of the Indian pulses might, with advantage, be cultivated in this country; and the trial would certainly be very desirable. As to their importation, it was suggested by one speaker that our farmers might possibly look upon their introduction with some jealousy. Whatever might be the feeling as to the importation of greatly increased amounts of wheat, I think there would be anything but a tendency to jealous feeling, at a considerable importation of these highly nitrogenous pulses. On the contrary, in these times, when high farming is daily gaining grouud, and the supplies of artificial nitrogenous manures are so much below the demand, it would be a great boon to the farmer to have a cheap source of these highly nitrogenous seeds, by which he would directly increase his production of meat and manure, and indirectly that of grain also.

But it is in relation to the bearings of Dr. Watson's

paper upon the "Chemistry of Food," and the practical application of dietetic principles, that I would chiefly call attention. No one can doubt that we owe an immensity to Baron Liebig for his admirable generalisations on the subjects of the chemistry of food, some dozen or fifteen years ago. Nor can it, on the other hand, be disputed, that, besides clearly defining the special offices of the nitrogenous and non-nitrogenous constituents of food respectively, he, in making allusion to the practical application of his principles, throughout assumed that the relative values of current food-stuffs would be measurable, more by the amount of their nitrogenous constituents than by the character and amount of their non-nitrogenous ones. Thus, even as late as 1851, he says:—

"The admirable experiments of Boussingault prove that the increase in the weight of the body in the fattening or feeding of stock (just as is the case with the supply of milk obtained from milch cows), is in proportion to the amount of plastic constituents in the daily supply of fodder." And, again, "It is found that animals require for their support less of any vegetable food in proportion as it is richer in these peculiar matters, and cannot be nourished by vegetables in which these matters are absent."

So far, indeed, throughout his writings on the subject, has it been the pervading idea that in our food the nitrogenous constituents were most likely to be found defective, that almost every subsequent writer and investigator has assumed this to be his view; nor, indeed, at the time he first wrote, was there experimental evidence at command to decide the question one way or the other. Our highest authorities, both in this country and abroad, especially those connected with agricultural chemistry, have for the most part, at any rate until recently, adopted the same view; and most of the tables of the composition of different articles of food have been assumed to indicate relative value according to relative amount of nitrogenous compounds. Sometimes, indeed, the writer has had an obvious misgiving, seeing that theory and experience were not in accord; but this has been accounted for generally to the disparagement of adopted practices. Those, however, who have been aided by careful observation, and especially those who, looking at the subject from a physiological and medical point of view, have weighed their experience with the light thus thrown upon it, have seen reason to call in question the validity of the prevailing opinions. It is, indeed, a particular satisfaction to see so marked a qualification of the notions referred to, in the papers by Drs. Letheby and Watson respectively, which have been read before the Society of Arts during the present year.

The experience of Mr. Lawes and myself, during a dozen years of laborious experimenting on the feeding of animals, has been to show that, as our staple food-stuffs go, both the amount of food consumed, and the amount of increase produced, have a much closer relation to the amount of non-nitrogenous constituents than to that of the nitrogenous ones.

The analysis of numerous half-carcasses of butchers' meat has shown us, that several such contained a larger proportion of respiratory or fat-yielding material in relation to nitrogenous or plastic compounds, than even bread. The results of this investigation will, however, shortly be published in full.

From the fact last mentioned, it will not be surprising that the average of the 86 dietaries calculated by us, as quoted by Dr. Watson (many of which contained liberal proportions of animal food), should have shown a proportion of gross non-nitrogenous constituents to nitrogenous ones, almost as high as in bread. And it may be mentioned that, provided about one-eighth of the total non-nitrogenous substance be supposed to be fatty matter, then the relation of the respiratory or fat-yielding to plastic or flesh-forming constituents, would be fully as high in the average of these 86 dietaries as in bread. The difference in the respiratory capacities of fat and the starch series of compounds was more than once called attention to by Dr. Watson, as affecting the relative value of the assimilable non-nitrogenous constituents of food.

That the existence of a certain amount of *fatty matter*, in some form or other, and particularly when duly blended with other matters, as in meat, constitutes the characteristic of a high class of dietary, much more than does a high relation of plastic to respiratory matter, there can be little doubt.

If instinct, and market price as influenced by it, are to be accounted as of any value in showing what are the natural calls of the system, and that our current articles of food are not valuable according to the amounts of the nitrogenous or plastic constituents they yield, the following facts will illustrate it sufficiently strikingly. At the present time we can purchase one pound of nitrogenous or plastic matter—

	s.	d.
In wheaten flour or bread for about	1	6
In beans and peas	0	4
In butchers' meat	5	0

It is, then, something else than their relative amounts of nitrogenous compounds which determines the relative values of our current foods in meeting the wants of the system. It is obvious that we could, at a very small cost, increase the per-centage of nitrogen in our bread, if that were all that were needed to make it a first-class food. But, supposing neither the plastic nor respiratory class of constituents deficient in actual *amount*, it is not, even then, immaterial in what form they are presented to the system. Drs. Letheby and Watson have insisted upon the necessity of keeping in view, not only ultimate chemical composition, but the condition and variety in which the constituents are presented. Nor is their any doubt that in the replacement of a certain amount of starch (and its congeners) by fat, there is generally something more, as regards the health and vigour of the body, than the mere substitution of chemical equivalents of respiratory and fat-yielding material.

In conclusion, referring to the Chairman's illustration, it may be remarked, that no one, so far as I am aware, has ever attributed to Baron Liebig the folly of recommending the repair of the material structure of an engine, when it was proved that fuel and steam were all that it required to keep it in vigorous working. There is, however, no doubt, that after showing with what materials the machine itself must be kept in order—what must be used as fuel—and that that which would serve only for the latter purpose could obviously not serve for the former—Baron Liebig, by the whole tenor of his argument on the application to practice of these principles, tacitly assumed that the repair of the machine would require a more assiduous attention than the supply of fuel.

Home Correspondence.

THE SMOKE QUESTION.

Sir,—In the recent discussion on Mr. Pellatt's paper, Mr. Greaves, after giving us the results of his most valuable large-scale experiments, arrived at the somewhat melancholy conclusion that the avoidance of giving off smoke costs 7s. a ton on the fuel used. In November, 1853, you published in the *Journal* a letter giving the results of our experience of mechanical self-feeding smoke-burning grates. A longer experience, with an increased number of furnaces, confirms the results thus given. We have never made a hobby of any particular smoke-burning contrivance, but the large quantity of steam required in our works has made the study of cheapness and efficiency of fuel an important one.

I will now give our present experience at Battersea works, and there only, as though we use similar apparatus at our other works, near Birkenhead and at Vauxhall, yet as Battersea factory is the principal one, using the largest quantity of fuel, and having the most perfect appliances for measuring the water evaporated, the results arrived at there are the most reliable ones.

At Battersea works, then, our consumption of small coal is two hundred tons weekly, at a cost varying from 9s. to 12s. per ton—take an average of 10s. 6d. Not having the advantage of shelter, they are more or less wet. With these we evaporate 6·7 lbs. of water per lb. of coal, as taken from the heap, and burn all smoke. We have some Cornish boilers, but prefer bi-tubular boilers, 5 feet 6 inches diameter, with the fire underneath, the furnaces being Hazeldine's or Juckes' furnaces 24 feet consuming 10·5 lbs. of small coal per foot per hour.

The coke employed by Mr. Greaves, at his average of 20s. 7½d., evaporates 100 gallons of water at a cost of 12·25d.

The small coal employed by us evaporates 100 gallons of water at a cost of 8·4d., and gives off *no* smoke.

I am, &c., GEO. F. WILSON.

Price's Patent Candle Company (limited),
Belmont, Vauxhall, London, S., December 6, 1857.

COAL AND COKE.

Sir,—It is a singular fact that, in the recent discussion on this subject, one or two points of primary importance were sadly lost sight of by all the speakers who addressed the meeting. It appeared to be taken for granted, when different kinds of fuel are to be experimented upon, that no change is required in the form, arrangement, and dimensions of the furnace, fire-grate, ashpit, or flues, that is to say, that the calorific powers of bituminous coal, coke, anthracite, wood, charcoal, or resinous matters, can all be effectually tested in the same furnace. A manifest absurdity. Coke producing a concentrated heat, with little flame and no smoke, must require a very different furnace for perfect combustion to that adapted for the use of bituminous coal, which gives out a diffused heat, with large flame, accompanied with abundance of smoke or gaseous products, and in carrying out experiments upon the evolution of heat from various species of fuel, the perfect adaptation of the furnace to each kind is indispensable, if reliable comparative results are to be obtained.

Again, the effect of differently formed ashpits upon the performance of a furnace is also totally ignored, while one half of the cause of our smoke-vomiting chimneys may be safely assigned to the very faulty construction of the ashpit, ever true to its name, as it is never more than a mere hole or pit, for the ashes to fall into. None of the innumerable inventions for the prevention of smoke ever included the slightest improvement in the ashpit.

Generally, engineers and contractors are required by their employers to confine the boilers to the smallest possible dimensions, and to put them in some out of the way hole or cellar, where, of course, the ashpit, the real *lungs* of the furnace, becomes contracted to a small hole sunk in the ground, with barely room to shovel out the ashes. The expedient often resorted to by millowners, of keeping the ashpit full of water, points to the evil; it is true that it saves the fire bars, but at a great loss of caloric by useless evaporation.

Insufficient boiler room, and a faulty ashpit, are the causes of half the smoke nuisance through a double action. The fires must be forced, and the extra draught required in consequence can only get to the underside of the fire bars in a very oblique direction, and through apertures ridiculously small and confined.

The first step towards true economy and the prevention of the smoke nuisance is to have abundance of boiler space, and the second will be a total reform in the setting of boilers, that is to say, the furnace must be so placed as to be over a large culvert open at both ends, if possible, and so constructed as to have four or five feet of perpendicular shaft, the full size of the furnace grate, immediately under the fire bars.

Of course, all furnaces confined within the boiler flue, with a diminutive fire space and nothing of an ashpit, must be condemned as extravagantly wasteful, and inveterate smokers, in spite of all the patent inventions and devices that may be adopted at the fire bridge or in the flues.

In the well-known "Prize Essay" on this subject, by Mr. Charles Wye Williams, there is scarcely an allusion to the subject of ashpits, and none whatever to the possibility of half the mischief being caused by their very faulty construction.

Mr. Williams acknowledges, however, that the Cornish system of firing is essentially the most economical in the evolution of heat from a given quantity of fuel in a given time; yet that gentleman still insists on the necessity for building and setting our furnaces and boilers on faulty and erroneous principles, and then curing the evils produced by means of costly patent inventions which seldom, however, meet with much success. Singularly enough, Mr. Williams goes on to state that the excellence of the Cornish system is "at the expense of time, space, and first cost of boilers."

The first item, "expense of time," is incomprehensible, for all boilers must, of necessity, furnish a given quantity of steam, at a given pressure, and in a given time.

The second, "expense of space," is absurd, because, if a man chooses to set up a 40-horse engine and boilers in a cellar, perhaps, 8 feet by 10 feet, he must abide by the consequences. It is true, that "space" costs rent in crowded towns and cities, but that is no reason why the inhabitants should be poisoned with the smoke or gaseous product ejected from the chimney shaft.

The last item, "expense of first cost of boilers," is surely a real source of economy, because boilers that do not require forcing or hard firing, will last out, perhaps, ten times those that require such treatment.

The effects upon combustion, by differently formed ashpits, may be readily tested by any person who possesses a common portable air furnace, by attaching to the body below the fire bars a sheet iron counter-funnel of the same size, five, ten, or fifteen feet long, terminating with a bell mouth, and carried perpendicularly downwards, if possible. He will soon perceive the enormous increase in the evolution of heat from such an addition.—I am, &c.

HENRY W. REVELEY.

Poole, Dec. 5, 1857.

COAL AND COKE.

Sir,—I am sorry I was not sooner aware of the reading of Mr. Pellatt's paper "On the Comparative Heating Properties of Coal and Coke," as I could then have furnished the particulars of the following experiments, which I have since obtained, and which to some extent would have confirmed his views.

The experiments were made on the boilers of a pair of engines used in forcing water for working some extensive hydraulic machinery, the constant pressure upon which was equal to a column of water 1,500 feet high. The coal was Newcastle Wylam, such as is commonly used in London for steam purposes, and the coke that which is supplied by the London gas works. The former cost 19s. per ton, and the coke 10s. per chaldron, which, reckoning the chaldron at 12 cwt., would be equal to 16s. 8d. per ton. The experiments occupied four weeks, and were of equal duration, namely, 90 hours each. The first experiment was on

Coal:

Time of working, 90 hours; number of strokes, by counter, 239,027; coal used, 14 tons. 9 cwt. 2 qrs. = 32,424lb, at 19s. per ton, = £13 15s. = 3,300d. = ·1017d. per lb.

Work done=1787 tons=4,002,889lb raised 1,500 feet=6,004,320,000lb raised 1 foot=185,180lb=raised 1 foot by 1lb of coal, at a cost of ·1017*d.*

COKE:

Time of working, 90 hours; number of strokes, by counter, 184,484; coke used, 12 tons. 14 cwt.=28,448lb, at 16s. 8d. per ton=£10 11s. 8d.=2,540d.=·0892d. per lb.

Work done=1,379·77 tons=3,090,684lb raised 1,500 feet =4,636,026,000lb raised 1 foot=163,000lb raised 1 foot by 1lb of coke, at a cost of ·0,892*d.*

Hence, the proportions between the weight raised and fuel used, are—for .... Coal, 185,180 to 1
Coke, 163,000 to 1.

And 163,000 is to 185,180 as 100 is to 113, so that, irrespective of cost, it appears that coal is 13 per cent. more efficient than coke, or one ton of coal would be equal to 22·6 cwt. of of coke. Again, 163,000 is to 185,180 as ·0892d. is to ·1013d., from which it appears that the *cost* of doing a given amount of work by coal or coke, weight for weight, would be as nearly as possible equal, the difference being only ·0004d.

Hence we may conclude that with coal at 19s., and coke at 16s. 8d. per ton, whether with regard to economy or efficiency, the results of using either will be as nearly as possible equal, the superior efficiency of the coal being compensated by the lower prices of the coke.

There is, however, a fallacy in thus reasoning, inasmuch as coal, by its conversion into coke, loses about 40 per cent. of its weight; it is therefore quite clear that this loss, added to the cost of manufacture, must necessarily render it more expensive than coal, unless, as in the experiments under consideration, its manufacture has not been a special and primary object.

It is probably owing to this that there exists so much difference of opinion on the subject, which led one of the speakers to represent his experiments as leading to the conclusion that—in the performances of a given amount of work—the cost when done by coals was 16s., and by coke 37s. 6d., the latter being, no doubt, locomotive coke.—I am, &c., JOHN LEONARD.

Mortimer-road, St. John's-wood, Dec. 7, 1857.

ON THE BURNING OF COKE AND THE SMOKE NUISANCE.

SIR,—In reference to the recent discussion at our Society on the "Substitution of Coke for Coal as a remedy for the Smoke Nuisance," I was sorry to find that the commercial view of the case absorbed almost the entire attention of the meeting.

I should have been more gratified if the hygienic side of the question had also been given; and it is in the hope of eliciting opinions on this view of the case that I now write these few lines.

Admitting that, in round numbers, there are *five million tons* of coal consumed in London, then we have, as the result, $5,000,000 \times 40 = 200,000,000$ cubic feet of coal $\times 10,000 = 2,000,000,000,000$ cubic feet of carbonic acid gas produced; if all this coal be converted into invisible fumes, and as *one* part of carbonic acid gas added to 1,000 parts of our atmosphere is sufficient to render that atmosphere injurious to health, we thus obtain the last figures, multiplied by one thousand, viz., 2,000,000,000,000,000 cubic feet of our atmosphere contaminated by the total combustion of *five million tons of coal*.

In other figures, more within comprehension, we have thus contaminated 13,560 square miles of air and one mile in depth, or about 117 miles square and one mile in depth. This is for the entire year, and if we divide by 365 days we have about six miles square and one mile deep of our London atmosphere daily contaminated, viz., a space equal to about the entire area of London if we exclude the suburbs.

As I have long taken a deep interest in the question of the abolition of the smoke nuisance, I shall feel much gratified if any one can prove that the law of the diffusibility of the gases is sufficient so to neutralise the above amount of carbonic acid gas as to render our London atmosphere wholesome under the above circumstances. I am, &c.,

GEO. WYLD, M.D.

6, Great Cumberland-street.

STEAM CULTIVATION.

SIR,—That part of Mr. Sidney's paper, read to the Society of Arts on the 9th inst., touching upon the application of steam to the tillage of the soil, appears to throw a damper upon its application to light lands, which, he says, are done at so little cost with horses that there appears but little chance for steam. Upon this point he and I differ. I believe it will be found that, within a very short time, there will be but few good light-land farmers who will not have and use a steam-cultivator of his own. Am I not supported in this view by Mr. Mechi, whom you report to have said that every farmer with 300 acres ought to have a steam threshing machine. Then, to have that, they must have got a steam engine; then, when it is not used in threshing, grinding, chaff cutting, &c., why should it not be used in tilling the soil when required, when nothing but a windlass, &c., and a few implements, comparatively costless, are required to start it. Here I will give a practical proof that steam can beat horses in cost on light land. It so happens that I have no light land on my farm, but that I had the good fortune to be invited, by the Royal Bucks Agricultural Society, to work my steam plough at their meeting, held at Newport Pagnell, in September last, and that they provided for its working a light gravelly soil wheat stubble field, on the farm of Mr. Rogers, of Lathbury, in which five men, with a boy to fetch water, and an eight-horse engine, ploughed, with my three coulter plough, five acres and a-half, eight inches deep, in five hours and forty minutes. The actual cost, including wear and tear, of this kind of work on my heavy land is 6s. 8d. per acre. All the filth was brought to the surface without being cut to bits. Mr. Rogers informed me that the clearing it off by hand, with forks, was comparatively costless, after which he put it in ridges with a ridging plough and two horses, and it is now like a perfect garden. Now I challenge any light-land farmer in England to produce the like result in the ordinary way at double the cost it has been to bring it to that beautiful state; I again say, why should not the engine that Mr. Mechi says every 300 acre farmer should have, be employed, when not otherwise required, in producing such results. The case above is not a solitary one. Lord Hatherton worked a set of my tackle on his estate at Teddesly, which is moderately light-working land, the whole of last summer. His lordship stated, at an agricultural meeting held at Stafford, in September last, that it had effected a saving of forty per cent. to him.

I am, &c.,

WILLIAM SMITH.

Woolston, Dec. 12, 1857.

Proceedings of Institutions.

BUCKS AND BERKS.—The annual meeting of the Lecturers' Association was held at the Town-hall, Windsor, on Thursday evening, Oct. 12. The chair was occupied by the Hon. and Very Rev. the Dean of Windsor. The attendance was tolerably numerous, and among those present were the Revds. Lord Wriothesley Russell, H. J. Ellison, T. H. Tooke, E. Hale, C. K. Paul, Ellis, C. D. Goldie, Flint, Haviland, T. Carter, Hodson, S. Major, Cotton, J. S. Blunt, Gore, H. Hawtrey, S. Neville, A.

Douglas, W. C. Bromhead, J. A. Miller, T. H. Stevens, Esq., Captain Wilson, Messrs. Clode, Phillips, Menzies, Brown, of Slough, &c. From the report read it appeared that, "There are now in union with the Association six Institutes (Windsor, Staines, Slough, Beaconsfield, Amersham, and Chesham), eleven Reading-rooms and Libraries (Burnham, Maidenhead, Colnbrook, Eton, Chalvey, Cumberland Lodge, Taplow, Bier Lane, Clewer Lane, Windsor Working Men's Association, and Woburn), and four school or class-rooms (Bracknell, Clewer-road, Shaw Farm, and Windsor Night Schools). In the course of the past season upwards of sixty lectures have been delivered by members of the Association at the various Institutes, &c., in union. The circulating libraries of the Association, nine in number, and containing about 500 volumes, are in constant use. Six of these (the Prince's Library) were presented last year to the Association by his Royal Highness the Prince Consort. The Committee, considering the encouragement of classes, both in Institutes and Reading-rooms, to be the most effectual mode of carrying out the aims of the Association, and hoping also to obtain practical results from the lectures and libraries, offered the following prizes, which were distributed to the successful competitors at this meeting:—1. A gratuity of £2 to the Institute or Reading-room with the greatest number of pupils for classes (in proportion to the number of members) during the season of 1856 and 1857; awarded to his Royal Highness the Prince Consort's Reading-room, Shaw Farm. 2. A gratuity of £2 to the Class whose members during the same time have been most regular in their attendance; awarded to Cranbourne. 3. A present of books to the value of £1, to the pupil who has attended his class with the greatest regularity; awarded to John Chitty, Colnbrook. In addition to these, prizes were awarded to the most proficient candidates in the examination held at the Windsor Institute, of all members of Institutes, &c., in union with the Association. The candidates, nine in number, were separated into two divisions, according to the subjects in which they elected to be examined. The examination was conducted by W. Johnson, Esq., M.A., the Rev. W. Wayte, M.A., R. Maltby, Esq., M.A., T. H. Stevens, Esq., and Rev. E. Hale, M.A. The subjects of examination were arithmetic, geography of the British Isles, history of Henry VII. and Henry the VIII., writing from dictation, English grammar, and composition." After the adoption of the report, and the distribution of the prizes, the meeting proceeded to the discussion of the following subjects:—1. Night schools for lads and adults. The best mode of conducting them. The best mode of giving help from the Association. 2. Lectures in their relation to the class-room and the library. The Rev. H. J. Ellison opened the discussion on the first subject, in a few observations, in the course of which he observed that the various educational efforts made in this country could as yet only be regarded as a series of experiments. Among these the system of night schools occupied an important position. They were the offspring of necessity, consequent upon the early age at which children were removed from school. The rev. gentleman dwelt upon the necessity of making the night school a place of discipline, and in time the pupil would become convinced that this strictness was conducive to his own advantage. The Vicar then gave various reasons in support of his opinion that it was expedient to keep separate rooms for the instruction of adults and lads. He afforded illustrations of the disinclination often exhibited by the former to mix with the latter. The degree of discipline rendered necessary in the case of youth would be inappropriate in dealing with adults. Reference was made to cases in which ladies might, under certain circumstances, render much assistance in this work. It was highly important that the system of education should be such as to convince those taught that it was calculated to supply the deficiency which they felt. It ought not to be of a character to induce them to despise manual labour, but calculated to make them better workmen, as well as better men. The great advantages derivable from securing the co-operation of the employers of labour was also dwelt upon, and the Vicar concluded by pointing out how, by a judicious system of rewards, associations of this kind could materially contribute to the success of night schools. The Rev. C. D. Goldie expressed his concurrence in the general principles laid down by Mr. Ellison, but he adverted to the difficulties experienced in practically carrying them out in all localities. The Rev. C. K. Paul dwelt upon the difficulty of maintaining a constant interest in these schools. He had often observed this interest flag after the first year, and it was necessary to resort to extraordinary means to resuscitate it. The Rev. E. Hale, the honorary secretary, offered a few remarks on the best mode of rendering aid to night schools by means of this Association, and remarked that the committee would be glad to receive any suggestions from those interested in the subject. The Rev. H. J. Ellison then read a sketch which he had drawn up of prizes to be given by this Association. It included various rewards for good conduct, regularity of attendance, as well as for proficiency in various branches of education. After various suggestions had been made by Captain Wilson, Mr. Hale, Mr. Goldie, and other gentlemen, Mr. Ellison summed up the discussion, offering various suggestions as to the best mode of obviating the difficulties which had been alluded to with respect to the maintenance of discipline, securing efficient teachers, and keeping up interest in the school. The meeting then proceeded to the discussion of the second subject appointed for the evening—"Lectures in their relation to the class room and the library." This subject was opened by the Rev. T. H. Tooke, who endeavoured to solve the question whether the lectures delivered by this Association had, on the whole, answered the purpose intended. He arrived at the conclusion that they had, if a proper view were taken of the object of lectures. In his opinion they ought not to be considered as primary or principal means of instruction. Their chief use was that of exciting a further interest in the subject discussed, so that the knowledge acquired by means of the lecture might be further perfected in the class room, and by means of the library, After some lectures it had been found that the books in the library treating of the subject or subjects embraced in the lecture were in great demand. This he looked upon as a natural and proper effect of lectures. The rev. gentleman dwelt at some length on the importance of rendering lectures simple, intelligible, and of selecting subjects calculated to promote education and to elevate the classes for whose advantage this Association had been formed. The Rev. E. Hale offered some remarks on the advantage arising from inducing pupils to prepare abstracts of lectures. He also dwelt on the difficulty of securing courses of lectures, so as to concentrate attention on one subject until it had been, to a certain extent, mastered. He thought that when the lectures were weekly varied it had a tendency to induce more miscellaneous reading. In noticing the books successively taken out of the library by members of institutions it was not often found that a systematic course of study was pursued. The Rev. C. D. Goldie thought that the lectures would be more interesting if they were simple. Many competent gentlemen shrank from offering their services as lecturers because they imagined that something extraordinary was required of them. Mr. Brown, speaking from his experience of the Slough Institution, was of opinion that variety in lectures secured larger attendances. The Rev. J. H. Ellison was disposed to adopt a view unfavourable to variety. The great question was whether these lectures were intended for amusement or instruction. If the lecture was intended to create an interest in the subject, to inculcate knowledge, and to diffuse more than a smattering acquaintance with the subjects treated, he was decidedly of opinion that courses of lectures ought to be encouraged

After observations by Mr. Sanders on the general results of the lectures held at the Eton Reading Room, and by Mr. Passmore on the success attending the labours of the Windsor Working Men's Association, the Rev. S. E. Major, Rev. A. Douglas, and Mr. Stevens, of Eton College, offered various suggestions bearing upon the topic under discussion. Mr. Tooke, who introduced the subject, having briefly summed up, the Dean expressed the pleasure he felt in presiding over the deliberations of the meeting. He also bore testimony to the interest manifested by his brethren the clergy in the success of this Association. He thought considerable advantages would result if Eton College were to grant certificates to pupils of schools in connexion with these institutions similar to the certificates granted by the universities to middle class schools. The chairman also alluded to the deep interest taken by his Royal Highness the Prince Consort in the welfare of the Bucks and Berks Lecturers' Association. After passing a vote of thanks to the Very Rev. the Dean the meeting separated.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered during the Vacation, 1857.

274. Public Libraries—Return.
263. Court of Chancery, &c. (Ireland)—Abstract of Return.
295. East India (Education of the Sonthals)—Copy of a Letter.
240. Bath City Election Petition—Minutes of Evidence.
303. Copyright (Colonies)—Return.
318. Hampton Court and Kew Gardens—Return.
338. Cathedral and Collegiate Churches—Return.
298. Military Savings Banks—Account.
275. Army—Account of Receipt and Expenditure for the year 1856.
276. Ordnance—Account of Receipt and Expenditure for the year 1856.
290. Assessment of Sugar—Return.
309. Gold (Australia)—Return.
339. Chapters—Return.
271. Orders of Knighthood—Account.
299. Redundant List (Public Departments)—Return.
308. Guano—Copies or Extracts of Correspondence.
242. Bury St. Edmund's Election Petition—Minutes of Evidence.
282. Episcopal Patronage—Return.
297. National Education (Ireland)—Return.
302. Order of the Bath—Return.
322. East India (Singapore)—Return.
344. Court of Chancery (Ireland)—Correspondence.
323. County Courts (1st January to 30th September, 1856)—Return.
324. County Courts (1st October to 31st December, 1856—Return.
220. Bank Acts—Report and Evidence, Part I.
279. Public Monies—Report.
255. Drogheda Election Petition—Minutes of Evidence.
265. County Treasurers (Ireland)—Account.
287. Lambeth Election Petition—Minutes of Evidence.
316. Bury Union (Workhouse Cemetery)—Correspondence.
317. Property Tax and Population—Return.
341. Bombay (Titles of Land Commission)—Returns.
342. East India (Liberty of the Press)—Copy of a Despatch.
293. Dublin City Election Petition—Minutes of Evidence.
49 (4). Trade and Navigation—Accounts (31st August).
163 (1). Wareham Election—Index to Minutes of Evidence.
177 (1). Galway Town Election—Index to Minutes of Evidence.
280. Revenue (Ireland)—Accounts.
311. Marlborough Election Petition—Minutes of Evidence.
233. Metropolitan Drainage—Report.
234. Metropolitan Board of Works—Report.
288. Poor Law (Ireland)—Returns.
243 (1). Beverley Election—Index to Minutes of Evidence.
262. Harbours of Refuge—Report from Committee.
326. Australian Mail Service—Return.
328. Local Board of Health—Return.
243. Election Petitions—Alphabetical List.
151. Bleaching and Dyeing Works—First Report.
273. Friendly Societies—Report of the Registrar.
291. Spirits—Accounts.
336. Pensions, &c. (Ireland)—Return.
241. Rating of Mines—Report and Evidence.
286. Coalwhippers Act—Lords Report.
49 (5). Trade and Navigation Accounts (30th September).
77 (B). Poor Rates and Pauperism—Return.
307. Colonial Government—Return.
321. Sittings of the House—Return.
294. Sale of Poisons, &c. Bill—Lords Report.
300. Army, Navy, and Ordnance—Detailed Accounts.
313. Education—Return.
148. Woods, Forests, &c.—35th Report of the Commissioners.
269. Contracts (Public Departments)—Report and Evidence.
312. Weights and Measures—Return.
319. Bank of England, &c.—Account.
77 (A 2). Poor Rates and Pauperism—Return.
246 (1). Westminster Bridge—Plans.
314. Contested Elections (Poor Law)—Return.
252. Hop Duties—Report.
224 and 260. Hudson Bay Company—Reports.
270. County and District Surveyors, &c. (Ireland)—Report.
327. Oxford University—Copy of Ordinances.
340. Railways (Amount of Capital, &c.)—Returns.
220 (1). Bank Acts Report, Part 2—Appendix and Index.
330. Electors (England and Wales)—Abstract of Return.
345. Vestry Clerks (Metropolitan Parishes)—Abstract of Return.
49 (6). Trade and Navigation Accounts (31st October).
346. Public Petitions—Return.
211. Bleaching and Dyeing Works—Second Report.
Honduras—Treaty of Friendship, Commerce, and Navigation.
China (Naval Forces at Canton)—Further Paper.
India (Mutinies in the East Indies)—Further Papers.
Tariffs—Return.
Trade of various Countries and Places—Abstract of Reports.
Public General Acts—Cap. 36-85, and Table.

Delivered 4th December, 1857.

1. Bank of England—Correspondence.

Session, 1857.

256. Paupers—Return.
301. Omnibuses and Cabs (Metropolis)—Return.

Delivered 5th and 7th December, 1857.

1. Bill—Bank Issues Indemnity.
East India (Mutinies)—Further Papers.

Session, 1857.

315. Seamen in Union Workhouses, &c.—Return.
337. Electors, &c. (Metropolis)—Return.

Delivered 8th December, 1857.

2. Public Income and Expenditure (Balance Sheet)—Account.
Spain (International Copyright)—Convention.

Delivered 9th December, 1857.

5. General Committee of Elections—Mr. Speaker's Warrant.
6. Police (Scotland)—Rules and Regulations.
East Indies (Mutinies)—Further Papers.

Session, 1857.

333. Parochial Elections—Abstract of Return.

Delivered 10th December, 1857.

3. Bill—Sir Henry Havelock's Annuity.

Delivered 12th December, 1857.

4. Bill—Oaths.
Agricultural Statistics (Ireland)—General Abstracts.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette*, *Dec.* 11, 1857.]

Dated 18th September, 1857.

2417. John May Munro, jun., of Bristol—An improved metal wheel-stock.

Dated 9th November, 1857.

2831. Alphonse René le Mire de Normandy, Judd-street, Brunswick-square—Improvements in the manufacture of soap.

Dated 13th November, 1857.

2836. William Devon, 4, Maryland-terrace, Stratford—An improved self-acting apparatus for flushing water-closets, and the means of connecting the same to water mains, part of which are applicable to the junction of gas or water pipes generally.
2859. George Sheppard, Fordingbridge, Hants—Improved machinery for cultivating land, or for cutting up and pulverizing the surface thereof.

Dated 16th November, 1857.

2872. Casimir Debax-Talabas, Castres, France—Improvements in lithographic printing presses.
2874. John Frederick Spencer, Brighton—Certain improvements in steam engines, and the apparatus connected therewith.
2876. Thomas Richardson, Newcastle-on-Tyne—An improvement in treating manganese ores.

Dated 17th November, 1857.

2878. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap.
2880. Daniel Foxwell, Manchester—The application of certain material for the backs of cards.
2882. George Tomlinson Bousfield, Loughborough-park, Brixton—Improvements in fire-arms, and in detonating compounds to be used therewith. (A communication).
2884. Richard Archibald Brooman, 166, Fleet-street—The manufacture upon circular frames of a fabric suitable for petticoats and other garments, and curtains and other articles of furniture, together with apparatus to be employed therein. (A communication).
2886. William Eardley Richardes, Bryn-Eithin, Aberystwith, South Wales—An improved war-weapon.

Dated 18th November, 1857.

2888. William Heward Bell, Pelton, Durham—Improvements in the permanent way of railways."

2890. Emile Alcan, Fore-street—An apparatus to be applied to looms for producing figured fabrics of all kinds. (A communication.)
2892. Andrew Frederick Germann, Frederick Gustavus Germann, and Joseph Germann—An improved propeller.
2894. Robert Clegg, Islington—Improvements in registering or indicating apparatus, applicable to the registration or indication of fares, the distances passed over by vehicles, the revolutions of machines or parts of machines, and other similar purposes.
2896. Philip Bettle, Messrs. Carley and Co., Ely-place—An improvement in the construction of watches.

Dated 19th November, 1857.

5897. William Smith, St. Paul's Corner, Norton, near Malton, Yorkshire—An apparatus for the purpose of protecting the turnip crop by destroying the turnip fly and other insects which are injurious to turnips and other plants.
2898. Charles Wye Williams, Liverpool—Improvements in steam engine boilers.
2900. Jean Baptiste Mirio, Paris—Improvements in the permanent way of railways. (A communication.)
2902. Reverend Theophilus Henry Hastings Kelk, Tonge, near Ashby de-la-Zouch—Improved metallic alloys.
2904. William Clay, Liverpool—Improvements in metal knees employed in the construction of ships, buildings, railway or other waggons or carriages, or other analogous purposes.
2907. Reinhold Goedicke, 29, John-street, Bedford-row—The suspending of the lines of electric telegraphs in the air by means of gas balloons across water and land, or the atmospheric telegraph.
2908. David Melvin, Glasgow—Improvements in machinery or apparatus for manufacturing heddles or healds for weaving.
2910. John Edmund Burningham Curtis, St. James'-road, Croydon—Improvements in apparatus for filing papers and documents.
2912. Thomas Frederick Brabson, Birmingham, and George Hughes, Yardley, Worcester—Improvements in door springs.
2913. William James Cantelo, Camberwell—Improvements in the preparation and application of graves or cracklings for the purposes of animal food and manure.
2914. Benjamin Keightley, Lofthouse, Wakefield—An improved apparatus for indicating and registering the flow or supply of air to mines and other places requiring ventilation.

Dated 20th November, 1857.

2916. John Hinks and George Wells, Birmingham, and Joseph Letiere Petit, Aston, near Birmingham—An improvement or improvements in metallic pens.
2918. Henry Walker and James Beaumount, Sand Field House, Mirfield, Yorkshire, and Joseph Gothard, Huddersfield—Improvements in steam engines.
2919. Henry Page, Whitechapel-road—Improvements in the manufacture of sheet and crown glass.
2920. Pierre Alphonse Brussaut, Mont de Marsan, France—An improved anti-friction apparatus for shafts, axles, and other revolving surfaces.

Dated 21st November, 1857.

2922. William Archibald Cooper, Dungannon, Ireland—Improvements in the navigation of steam and other vessels.
2924. Napoleon Felix Boreiko de Chodzko, Paris—Improvements in furnaces for heating boilers.
2926. Samuel Hall, 19, King's Arms-yard, Moorgate street—An improvement in apparatus for igniting matches and other articles.
2928. James Wright, 19, Alfred-place, Newington Causeway—Improvements in the mode of treating madder for printing, dyeing, and distilling purposes, and also in the preparation and treatment of silk, cotton, and woollen cloth for printing and dyeing. (A communication.)

Dated 23rd November, 1857.

2930. Walter McFarlane, Glasgow—Improvements in moulding or manufacturing cast-iron pipes and other generally similar hollow articles.
2932. Charles Barlow, 89, Chancery-lane—Improvements in steam and air engines and furnaces therefor. (A communication.)
2934. David Hulett, 55 and 56, High Holborn—Improvements in cocks, taps, and valves, and in joints for pipes and tubes.

Dated 24th November, 1857.

2936. Thomas Coxon Wilkinson, Ashford, Kent—Improvements in pump valves.
2937. Joseph Schloss, 75, Cannon-street West—A so-called Diana lock or improved fastening.
2938. George Lowry, Salford—Certain improvements in machinery for heckling flax and other fibrous materials.
2939. William Scarby, Newgate-street—An improved form of elastic spring, applicable to bedsteads, sofas, chairs, the padding and seats of carriages, and other similar purposes. (A communication.)
2940. Charles Sands, Felix-terrace, Liverpool-road—Improvements in stereoscopes.
2941. Augustus Frederick Butler, Ceylon—Improvements in machinery for pulping coffee.

Dated 25th November, 1857.

2943. Robert Willan, James Abbott, and Daniel Mills, Blackburn, Lancashire—Improvements in looms.
2945. Antoine and Jean Martin, Trieste—Improvements in cleaning, and in preventing the formation of deposits and incrustations in steam boilers.
2947. James Hogg, London—An improved safe or depository for cash, deeds, or other valuables.

Dated 26th November, 1857.

2949. William Thomas Manning, 20, Great George-street, Westminster—Improvements in the treatment of sewerage and in the apparatus employed therein.
2951. Charles Farrow, Great Tower-street—An improvement in fire-arms.
2953. Henry Woodward, Birmingham—A new or improved knife-cleaner.
2955. James Higham and George David Bellamy, Plymouth—An improvement in the manufacture of soap.

Dated 27th November, 1857.

2957. Thomas Wheeler, Albion Works, Oxford—Improvements in machinery or apparatus for cutting turnips and other roots.
2959. William Elcock and Samuel Bentley, Wednesbury—Improvements in elbows used for joining wrought iron and other pipes or tubes, and in tools for manufacturing the said elbows.

Dated 28th November, 1857.

2961. Major Arthur Vandeleur, Royal Arsenal, Woolwich—Improvements in the construction of fire-places and passages for air of air furnaces, by which (without machinery) the intensity of the fire is increased, a saving of fuel effected, and the smoke consumed.
2963. Marc Antoine François Mennons, 39, Rue de l'Echiquier, Paris—An improved "tell-tale" clock or timekeeper. (A communication.)
2965. William Binns, Claremont-villa, Victoria-grove, Brompton—Certain improvements in the treatment and application of surcharged or superheated steam.
2967. William Massey, Newport, Salop—Improvements in guides or conductors to be applied to machinery or apparatus employed for winding or coiling chains, ropes, lines, thread, wire, or other similar articles.

Dated 30th November, 1857.

2969. Joseph Gardner and Richard Lee, and Henry George Pearce, Improvements for self-reefing sails.
2971. Henry Deacon, Woodend Chemical Works, Widnes Dock, near Warrington—Improvements in apparatus employed in the manufacture or production of caustic soda from liquors obtained in the manufacture of alkali, and applicable also to the manufacture or production of soap.
2973. John Palmer de la Fons, Carlton-hill, St. John's wood—Improvements in apparatus for retarding omnibuses and other carriages.
2975. Richard Archibald Brooman, 166, Fleet street—Improvements in casks and other vessels for containing liquids. (A communication.)
2977. Charles Goodyear, Leicester-square—Improvements in the manufacture of buoyant fabrics, which are applicable to the manufacture of garments, carpets, rugs, cushions, mattresses, bags, and various other useful articles.

INVENTION WITH COMPLETE SPECIFCATION FILED.

3023. Frederick Oldfield Ward, Cork-street, Burlington-gardens—Improvements in the manufacturing manure and obtaining accessory products. (Partly a communication.)—5th December, 1857.

WEEKLY LIST OF PATENTS SEALED.

December 11th.

1641. Josiah Latimer Clark.
1649. George Davies.
1657. George Lister.
1702. Thomas Lowell Ralph, and Thomas Lowell Ralph, jun.
1707. George Washington Charlwood.
1710. Stanislas Tranquille Modeste Sorel.
1719. William Edward Newton.
1761. Robert Mallet.
1840. Augustus Philibert Malard.
1857. Emanuel Ruegg.
2281. Joseph Gilbert.
2556. John Talbot Pitman.

December 15th.

1456. Edwin Travis and Joseph Louis Casartelli.
1668. Charles Vero and James Everitt.
1675. William Young.
1678. William Smith.
1687. William Barnard de Blaquiere.
1688. Richard Goulding.
1689. Philipp Kurten.
1708. Horace Hollister Day.
1712. Simon Pincoffs.
1722. William Wright.
1736. James Gascoigne Lynde.
1738. George W. La Baw.
1740. William Edward Newton.
1752. Daniel Evans.
1764. George Ireland.
1788. James Lamb Hancock.
1842. Thomas Moy.
1960. Thomas Ashton.
2242. Francis Preston.
2294. Thomas Gray and George Joseph Gladstone.
2344. William Geach.
2480. James Jackson.
2488. Thomas Crick and John Throne Crick.
2588. Jonathan Parker.
2614. Charles Coffey Alger.

Patents on which the Stamp Duty of £50 has been Paid.

December 7th.

2604. William Grindley Craig.

December 8th.

2593. Edward Maniere.
2602. William James Harvey.
2630. Jas. Hedgate, Jas. Thornton, and Edwin Ellis.

December 9th.

2632. Llewellyn William Evans and James McBryde.
2671. William Porter Dreaper.
2686. Richard Whytock and Thomas Preston.

December 12th.

2605. Isaac Dodds.
2610. Christian Henry Rd. Ebert and Lippman Jacob Levisohn.
2643. Luke Turner.
2692. William Bertram.
2697. Jabez Smith.

Journal of the Society of Arts.

FRIDAY, DECEMBER 25, 1857.

COUNCIL MEETING.

Wednesday, December 23, 1857.

The following Institutions have been taken into Union since the last announcement:—

448. Sheffield, Mechanics' Institution.
449. Bideford, Mechanics' and Literary Institute.

NOTICE TO INSTITUTIONS. CONFERENCE.

The Council have fixed to hold a Conference of Representatives from Institutions in London and the neighbourhood, with a view to the organisation of Local Boards in connection with the Examinations. The Conference will take place on Monday evening, the 11th of January, at six o'clock, when the attendance of two or three Representatives from each Institution is invited. Representatives from Institutions not in Union with the Society are also invited to be present.

EXAMINATIONS.

The Council have assented to the proposal, made by the Institutional Association of Lancashire and Cheshire, that they may be allowed to hold the Preliminary Examination for 1858 in Lancashire and Cheshire, in Easter week, six weeks before Whitsuntide, instead of twelve weeks before, as laid down in the Programme; the report to be furnished to the Council not less than five weeks before Whitsuntide.

THE LIQUID MANURE QUESTION.

The attention of the Council having been called to an extract from *Bell's Weekly Messenger* inserted in the *Journal* of the 25th of September, they desire to express their regret that it should have been inadvertently inserted, as containing observations reflecting personally upon individuals.

VANILLA.

Some little time since the Society received, through Mr. Blechynden, the Secretary of the Agricultural and Horticultural Society of India, some pods of the *Vanilla aromatica* and *V. planifolia*, grown in the garden belonging to that Society. Mr. Blechynden writes, in reference to these pods, as follows:—

"These plants have been some years introduced into India, but it is only recently that we have been able to obtain fruit from them by resorting to artificial means. The plant is propagated most readily, and will no doubt be soon naturalised here." The pods have been placed in the hands of Messrs. Cartell and Brown, of Princes-street, Leicester-square, for trial, who report as follows:

"We have used the vanilla sent, and find the strength good. The pods were very small, and were much dried in consequence of being packed in wadding, instead of being wrapped in tinfoil and packed in a tin case. We consider it of good quality. To make it of commercial value the pods should be long and of a very dark colour, almost approaching to black. They should also be moist, and if properly ripened before being packed, they become, after a time, covered with minute acicular crystals, which much add to their appearance and marketable value. The value of the pods sent was about 50s. per lb. Had it been fine (say 1½ inches longer), and in the condition above mentioned, it would realise from 80s. to 90s. per lb. The present price of vanilla is about 20s. per lb. above the average value."

ON THE COMPARATIVE CAPABILITIES OF STEAM-SHIPS AS DEPENDING ON THEIR MAGNITUDE.

By Charles Atherton, Chief Engineer, Royal Dockyard, Woolwich.

Experience of the past four years, especially in connection with the steam transport service of the Crimean war, events now in progress as respects our steam communication with China and India for military purposes, the present aspect of the probable future, opening up as it does a totally new era and order of things as respects mercantile intercommunication between England and the far distant regions of India, Australia, China, California, and Japan, involving the circumnavigation of the globe by the agency of steam, are circumstances which at the present time give peculiar significance to an inquiry which of late I have been instrumental in agitating, viz., an inquiry into the capabilities of steam-ships of extraordinary magnitude as compared with the capabilities of vessels of ordinary size. Under the influence of these convictions, as to the material importance of this subject, vitally connected as it is with the future advancement of arts, manufactures, and commerce, I beg to be permitted to avail myself of the facilities afforded by the *Journal of the Society of Arts* to promulgate certain inquiries and investigations on the subject referred to, and which, though previously brought forward elsewhere,* have never been subjected to the ordeal of public discussion, such as the importance of the inquiry undoubtedly demands.

Having thus briefly explained the purpose of my communication, I proceed, with your permission, to bring before the notice of your numerous readers the views which I entertain in demonstration.

1st. As to the superior capabilities of large ships, as compared with smaller vessels, in a purely mechanical point of view, for the performance of any specified length of voyage, without re-coaling, at any given rate of speed.

2nd. As to the mercantile limitations at which the admitted mechanical advantage which results from increased size of ship becomes neutralised, if, on the strength of increased size alone, we undertake mercantile obligations involving the stipulated performance of an increased rate of speed, combined with an increased distance without re-coaling, such, for example, as making a long passage direct without touching at intermediate coaling stations, which may be accessible to, and made available by, smaller vessels.

The elemental data on which the following tabular statements have been calculated are as follow, viz.:—That the weight of the hull and equipment (exclusive of the engines and coals), when ready for sea, will appropriate 40 per cent. of the mean displacement; that the weight of the engines, boilers, &c., in complete working order, will be 5cwt. per indicated horse-power; that the consumption of coals will be at the rate of 4½lbs. per indicated horse-power per hour; that the type and con-

* Appendix to Atherton's "Steam Ship Capability" (2nd Edition).

dition of vessel, and the performance of the engines, will be such as when deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C$ will give a co-efficient or index number (C) equal to the number 215·5, which is believed to be a high average estimate of the scale of duty performed by steam-ships at sea.

With these elemental data, it is purposed to show, in tabular form, the respective capabilities of a series of vessels of the following progressive sizes, as measured by their mean sea-displacement, viz., 5,000 tons mean displacement, 10,000 tons, and 20,000 tons mean displacement, the mutual relations of displacement, power, and speed being calculated by the formula above stated.

Table No. 1, showing the superior capability of large ships, as indicated by a progressively increasing rate of speed corresponding to a progressively increasing size of ship; the proportion of displacement to power being assumed, in all cases, constant, namely, two tons weight of displacement to one indicated h.p., of 33,000 lbs., raised one foot per minute:—

Displacement. Tons.	Indicated H.P.	Speed. Knots.
5000	2500	12·27
10000	5000	13·25
20000	10000	14·31

Hence, it appears that the same proportion of power to displacement which drives ships of 5,000 tons displacement 12 knots an hour will drive a ship of 10,000 tons, on the same type of build, at 13 knots, and a ship of 20,000 tons at 14 knots per hour.

Table No. 2, showing the superior capability of large ships as indicated by the progressively reduced ratio of power to displacement, whereby a constant speed is given to vessels of progressively increasing size; the calculation being made for the constant speed of 15 nautical miles an hour:—

Displacement. Tons.	Speed. Knots.	Indicated H.P.	Ratio of Displacement to Indicated H.P.
5000	15	4569	100 to 91
10000	15	7252	100 to 72
20000	15	11513	100 to 57

Hence, it appears that to attain the speed of 15 knots an hour, the ship of 5,000 tons displacement requires 91 Indicated H.P. for each 100 tons of displacement; but the ship of 10,000 tons displacement, on the same type of build, requires 72 Indicated H.P. for each 100 tons displacement, and the ship of 20,000 tons on the same type of build will require only 57 Indicated H.P. for each 100 tons of displacement.

Table No. 3, showing the superior capability of large ships as indicated by the progressively increasing distance capable of being run, without re-coaling, at a given rate of speed (say 15 knots an hour), and with a given per centage of the displacement appropriated to cargo (say 10 per cent.)

Mid-passage Displacement.	Speed.	Indicated H.P.	Cargo (10 per cent. of Displacement).	Coal.	Distance (without re-coaling).
Tons.	Knots.		Tons.	Tons.	Naut. Miles.
5000	15	4569	500	2716	4440
10000	15	7252	1000	6374	6555
20000	15	11513	2000	14244	9240

Hence, it appears that, at the speed of 15 knots an hour, and with 10 per cent. of the displacement appropriated to cargo, the ship of 5,000 tons displacement will steam a distance of only 4,440 miles without re-coaling; but the ship of 10,000 tons will, under the same conditions, steam 6,555 miles without re-coaling, and the ship of 20,000 tons, will, under the same conditions, steam 9,240 miles without re-coaling, at the speed of 15 knots per hour.

Table No. 4, showing the superior capability of large ships as indicated by the reduced consumption of fuel per ton of cargo at which goods will be conveyed a given distance, without re-coaling, at a given speed; supposing, for example, that the distance, without re-coaling, is to be 3,250 nautical miles and the speed 10 nautical miles an hour:—

Mid-passage Displacement.	Speed (per hour)	Indicated H.P.	Distance.	Coal.	Cargo.	Tons of Coal per Ton of Cargo.	Deep-draught Displacement.
Tons.	Knots.		Naut. Miles.	Tons.	Tons.		Tons.
5000	10	1354	3250	884	2219	·40	5442
10000	10	2149	3250	1403	4762	·29	10701
20000	10	3411	3250	2227	10034	·22	21113

Hence, it appears that, in the case of a 3,250 miles direct passage at 10 knots an hour, by increasing the size of the ship from 5,442 tons to 21,113 tons of deep-draught displacement, the consumption of coal per ton of cargo conveyed is reduced from $\frac{40}{100}$ down to $\frac{22}{100}$ being a reduction of nearly 50 per cent in favour of the larger ship.

The foregoing tables having thus illustrated the superior capabilities of large ships as compared with smaller vessels for the performance of any special service under the same specific conditions of speed and distance without re-coaling, the following table (No. 5) is intended to show how soon the admitted advantages which result from increased size become neutralized, if, on the strength of increased size alone, we undertake obligations which involve, on the part of a large ship, an increased rate of speed combined with an increased distance, without re-coaling; to demonstrate which, we will assume that in the prosecution of a steam-ship project on a line of communication extending a distance of 12,500 nautical miles (such, for example, as the line between England and Calcutta), it is intended to employ shipping to the aggregate extent of about 20,000 tons, to be propelled by steam-power in the proportion of 2 tons of Displacement to 1 Indicated H.P. The problem now is to determine whether, as respects speed and the consumption of coal per ton weight of cargo conveyed, the proposed service will be most advantageously performed by

Scheme No. 1, viz.,

One vessel of 20,000 tons Mean or Mid Passage Displacement and 10,000 Indicated H.P., making the passage of 12,500 nautical miles *direct*, at the speed of 14·31 nautical miles an hour; or by

Scheme No. 2, viz.,

Two vessels each of 10,000 tons Mean or Mid Passage Displacement and 5,000 Indicated H.P., making the passage in 2 stages of 6,250 nautical miles, at the speed of 13·25 nautical miles an hour; or by

Scheme No. 3, viz.,

Four vessels each of 5,000 tons Mean or Mid Passage Displacement and 2,500 Indicated H.P., making the passage in 4 stages of 3,250 nautical miles, at the speed of 12·27 nautical miles an hour.

It will be found by calculations based on the data before referred to, that the mutual relations of displacement, power, speed, length of passage, cargo, and coals, which result respectively from the above mentioned three

schemes of shipping, will be as represented by the following TABLE, No. 5:—

Scheme.	Mean or Mid-passage Displacement.	Indicated H.P.	Speed per hour.	Distance 12500 Nautical Miles.	Steaming Time.	Consumption of Coal on the entire passage.	Cargo.	Coal per Ton of Cargo.	Deep Displacement.
	Tons.		N.M.		D.H.	Tons.	Tons.	Tons.	Tons.
1	20000	10000	14·31	1 stage of 12500	36·10	17550	725	24	28775
2	10000	5000	13·25	2 stages of 6250=12500	39·8	9478	2381	4	12369
3	5000	2500	12·27	4 stages of 3250=13000	44·3	5316	1711	3	5664

From the above table we observe the following results, namely:—

The steaming speeds by the above proposed 3 Schemes respectively will be at the rate of about 14, 13, and 12 nautical miles per hour: the steaming time at sea on the passage of 12,500 miles will be about 36, 39, and 44 days by the 3 Schemes respectively, and allowing 4 days for re-coaling the 10,000 tons ship (Scheme No. 2) at the one intermediate station, and 2 days for re-coaling the 5,000 tons ship (Scheme No. 3) at each of the three intermediate stations, being altogether 6 days: then the whole time of passage between England and Calcutta by the 3 Schemes respectively would be 36 days, 43 days, and 50 days; being 14 days shorter time of passage in favour of the one ship (Scheme No. 1) as compared with the 4 ships (Scheme No. 3); but the Mercantile sacrifice which attends this saving of 14 days by Scheme No. 1, as compared with Scheme No. 3, is, that by Scheme No. 1, 17,550 tons of coal are consumed in the conveyance of only 725 tons of cargo, being at the rate of 24 tons of coal per ton of cargo, while *each* of the 4 ships of Scheme No. 3 consumes 5,316 tons of coal in the conveyance of 1,711 tons of cargo, being at the rate of 3 tons of coal per ton of cargo. Thus, notwithstanding the superior capabilities of large ships as compared with smaller vessels for performing any special service on equal conditions in regard to speed and distance without re-coaling (as shown by Tables 1, 2, 3, and 4,) we see, in the case now before us, (as shown by Table No. 5,) assuming each ship to make the same number of passages per annum (for, the larger ships, though a shorter time at sea, will be detained the longer in port,) that the four ship Scheme, No. 3, as compared with the one ship Scheme, No. 1, is, under the different conditions as to speed and coaling stations above stated, capable of transporting between England and Calcutta nearly 10 times the aggregate weight of cargo per annum with one-eighth of the consumption of coal per ton of cargo conveyed, but with an admitted sacrifice of 14 days on the time of passage.

If, however, the consumption of fuel on board of ship be reduced from 4½ lbs. per Indicated H.P. per hour, on which the foregoing calculations have been based, down to 3 lbs. per Indicated H.P. per hour, which is theoretically possible, and, therefore, it is hoped, may be achieved, then, on the same principle of calculation and under the above stated conditions as to loss of time by Scheme No. 3, it would still be found that the four ship Scheme, No. 3, as compared with the one ship Scheme, No. 1, would transport about double the weight of cargo per annum between England and Calcutta with about one-half of the consumption of fuel per ton of cargo conveyed, but, as before stated, with an admitted sacrifice of 14 days on the time of passage.

The consumption of fuel per ton of cargo conveyed is, as one item of expense, perhaps the best criterion of the relative merits of different Schemes of Steam Navigation as respects mercantile economy; and, on inspecting Table No. 5 with reference to this point, it will be observed that the 2nd and 3rd Schemes are very nearly on a par with each other, that is, under the assumed working arrangements of these schemes as above set forth, a vessel of 5,664 tons deep-draught displacement fitted for steaming at 12 knots per hour, and re-coaling at intervals of 3,250 miles, will convey cargo somewhat more economically than a vessel of 12,369 tons deep-draught displacement fitted for steaming at 13 knots per hour, and re-coaling at intervals of 6,250 nautical miles, and as compared with a vessel of 28,775 tons deep-draught displacement fitted for steaming at 14 knots per hour, and making the passage of 12,500 miles direct, without re-coaling at any intermediate station, the difference in point of freight economy, as indicated by the economy of coal per ton of cargo conveyed, is so greatly in favour of the smaller vessel, time excepted, that a vessel working under such conditions, viz., 14 knot speed combined with a 12,500 mile distance, without re-coaling, can only be regarded as a packet-ship for mails and passengers not profitably available for mercantile cargo.

If, however, the ship for Scheme No. 1 be constructed for a deep-draught displacement of 26,000 tons, and be fitted for the reduced speed of 12 knots per hour, the direct passage of 12,500 miles would then occupy 44 days, the consumption of fuel at 3 lbs. per Indicated H.P. per hour would be 12,000 tons, and the displacement available for cargo would be 4,000 tons weight, being at the rate of 3 tons of coal per ton of cargo conveyed, or about the same expenditure of coal per ton of cargo as that incurred by each of the 5,664 tons ship, (Scheme No. 3) steaming at the same speed, viz., 12 knots per hour, but re-coaling at intervals of 3,250 nautical miles, and taking, including stoppages (6 days) for re-coaling, 50 days for the passage; being an admitted superiority of 6 days in favour of the direct passage of the ship of 26,000 tons. The question is, whether this result, viz., the saving of 6 days by the large ship, will adequately compensate for the extraordinary requirements of its realisation.

In all the foregoing statements, the mutual relation of displacement, power, and speed, have been calculated without reference to the influence of wind and current, which, indeed, may be regarded as obstructing the regular performance of a high speed service; for, a favourable wind, such as might help a vessel steaming at 12 knots an hour (as in Scheme No. 3), may afford no aid or even oppose a vessel steaming at 14 knots an hour (as in Scheme No. 1); and an adverse wind will obstruct a vessel steaming at a high speed in a greater ratio than it would obstruct the low speed ship.

Sailing clippers scarcely average 7½ knots per hour; an average speed of 10 knots may be expected from the joint action of sail and auxiliary steam-power, but an average speed of 15 knots outruns even a favourable wind, and can only be depended upon from steam alone.

The foregoing remarks presume on there being no limitation to the draught of water whereby the ship of extraordinary magnitude may be prevented from having that type of form, as respects the proportions of length and breadth to depth, which is found to be most conducive to the realisation of a high scale or co-efficient of dynamic duty, and which may be adopted in the construction of the smaller vessels, its rivals. This is one obstacle tending to limit the magnitude of ships, and another obstacle of a somewhat analogous character consists in this, viz., that the cost of the construction of ships, and in some respects the working charges on shipping, are regulated by their nominal tonnage, either builder's tonnage or register tonnage, and it admits of demonstration, that neither the builder's tonnage nor the register tonnage is any definite or proportional measure of the respective weight-carrying capabilities of ships of different proportions of build, but it is found that the shallower a ship is in proportion to her beam, the smaller will be her weight-carrying capability in proportion to her builder's or register tonnage. For example: a ship of 1000 tons builder's measure, of which the load-draught of water is one-half of the beam,

may be able to carry 800 tons weight, but another ship of 1000 tons, having the load-draught of water only one-third of the beam, would probably carry only 450 tons, and yet the cost of construction of both these ships may be nearly the same, though one is capable of carrying nearly double the weight of the other.* Hence, therefore, the probability of a ship of extraordinary length and breadth, but comparatively shallow depth, being constructively an expensive ship in proportion to her capability for carrying tons weight of cargo, even though always loaded down to her deep draught line, but it is to be observed that such vessels, though unfavourable for heavy cargo, afford great accommodation for the conveyance of passengers.

Such are a few deductions from mechanical principles, which, irrespectively of commercial considerations as to the loss which may result from monster ships being laid up for repairs, or inadequately loaded on the one hand, or the market of their destination being suddenly glutted on the other, manifestly constitute most serious matter for reflection in connection with monster ships; times and circumstances may demand their use, but times and circumstances also impose limits, both mechanical and mercantile, to the advantageous construction and employment of monster ships, which, if not duly considered, are likely to result in a monster mistake.

THE PURCHASE OF THE SOULAGES COLLECTION FOR PUBLIC INSTRUCTION.

Another effort is being made to prevent the dispersion of this useful collection. The Manchester Art Treasures Committee, not having realised a sufficient surplus to secure the collection for Manchester, have been obliged, according to their agreement, to offer it to the Government, and, with the view of pointing out the great practical value of the collection to the Decorative Arts, two influential deputations have recently waited upon Lord Granville, as President of the Council of Education.

The following gentlemen attended as a deputation, representing manufacturers and others connected with art industry:—Messrs. Holland, Gillow, Trollope, Phillips, Hart and Son, P. Graham, and Crace, all of London; and Mr. Charles Ratcliff, of Birmingham, who represented the Mayor of that town, that gentleman being unable to be present. A deputation also attended from the Royal Institute of British Architects, consisting of Mr. W. Tite, M.P., Professor Donaldson, Mr. Digby Wyatt, Mr. Owen Jones, and other members of that body.

The deputation was introduced to the Lord President of the Council by Mr. Tite, M.P., (in the unavoidable absence of Earl de Grey,) who briefly explained the motives which had caused the deputation to ask for an interview with Lord Granville.

Professor Donaldson then addressed Lord Granville, dwelling upon the duty incumbent on the government of the country to secure every available material for developing technical industry in its alliance with art. In this country, every object which constituted such material rose to so great a value as to set a practical bar to the accumulation of works for purposes of instruction to any considerable extent. The Professor enumerated various instances of the rapid increase which had taken place of late years, and indeed very recently, in the cost of objects of *vertu*, and dwelt upon the opportunity which had been lost by her Majesty's government of acquiring the fine collection dispersed after the death of the late Mr. Bernal.

Mr. Owen Jones represented the importance of the practical lessons to be derived from the objects which constituted the Soulages' Collection; and he felt sure it was scarcely necessary to press upon the Lord President of the Committee of Council on Education the excellent results which must accrue to the trade and commerce of this country, whenever the workmen of the present age should be enabled to rival, in a graceful union of art with industry, the workmen by whom the valuable series of objects under consideration had been produced.

Mr. Digby Wyatt drew attention to the great encouragement given to the productions of partially educated workmen at the present time, and to the danger which might result from that encouragement, unless models of the highest excellence were kept constantly before the eyes of artisans, as an inducement and encouragement to them to attain the highest degree of excellence, and not to be contented with the cheap and rapid production of mere mediocrity. He felt assured that this question might most justly be entertained, not upon local grounds only, but upon those of the important interests of the nation at large. The extent of the commerce resulting in France from the intimate connection between art and industry was so great as to prove a source of vast revenue to the country; and it was certain that any measure by which an honourable competition might be entered upon between this country and our neighbours, in the production of objects calculated to minister to luxury, would be fraught with the happiest results. The objects which composed the Soulages' Collection had been produced at the richest period of Italian grandeur, and when society, in respect to its demand for articles of luxury, was upon a somewhat parallel footing with that which obtained at the present day. That class of objects could not, therefore, but offer most important practical lessons.

Mr. Tite, M.P., spoke of the small amount of the sum asked for the Soulages' Collection (about £14,750) as compared with the vast interests connected with the art industry of this country; and he was inclined to believe that any sum of money of a moderate amount, expended in the formation of industrial museums, could not but result in a most satisfactory increase of the revenue of the country.

Mr. Peter Graham (of the firm of Graham and Jackson, Oxford-street), on the part of the manufacturers of the metropolis, spoke in favour of the purchase by the Government of the Soulages' Collection. The manufacturers of this country were placed at great disadvantage, as compared with other countries, in respect of such collections as that about the purchase of which they had assembled. Such a collection suggested new forms—new ideas—greater variety—and materially assisted art and decorative operations. It was not London alone that wished Government to purchase the collection, but manufacturing towns in the country, such as Birmingham, were desirous that the collection should be purchased for the nation. It was desirable that the collection should be purchased with the least possible delay, for some of the objects became more and more rare every day, and, therefore, became enhanced in price.

Mr. Ratcliff (of Birmingham) said the mayor of the town which he had the honour to represent on that occasion would have been present at the interview, but for the intervention of official duties. He, however, was authorised to say that the mayor was most anxious that the Soulages' Collection should be purchased by Government, being well aware of the great advantages which it was calculated to confer upon the manufacturing interests of the country, and that it would be most valuable to Birmingham.

Earl Granville said he so entirely concurred with the general feeling which had been expressed by the deputation, that their words were almost equivalent to an attempt to convert a convert—(A laugh). The difficulties in the way, as they must be well aware, were, so far as he was concerned, entirely of a financial character. While constant efforts were being made by the ministry

* See *Journal of the Society of Arts*, No. 249, "Suggestions for Statistical Enquiry into the Extent to which Mercantile Steam Transport Economy is Affected by the Constructive Type of Shipping, as Respects the Proportions of Length, Breadth, and Depth," by Charles Atherton.

to reduce taxation, any proposal involving an unforseen expenditure was sure to be regarded with great apprehension, if not disapprobation. This question must, however, he felt, rest upon its intrinsic merits; and he thought they had only to be placed in a sufficiently strong form before the heads of her Majesty's Government to induce them to lend a willing ear to the present application. He should consult his colleagues on the subject, and probably it might be well if some gentlemen who took an interest in it waited upon the Chancellor of the Exchequer, as it was a matter involving the expenditure of money.

In accordance with the suggestion of Lord Granville, steps are being taken by many influential persons engaged in the decorative trades to obtain such an expression of their sense of the value of this collection, as to render it difficult for the Chancellor of the Exchequer to refuse their request, unless he is prepared to advise Parliament to withdraw all State aid from the British Museum, National Galleries, and other public collections.

FIRE AND POLICE TELEGRAPH.

By Sydney S. Waterlow.

The following is a plan for effecting telegraphic communication between police and fire brigade stations of the metropolis. As these matters are at present under the authority of three distinct bodies, it would be necessary to have a distinct telegraph for each body, perfect in itself, but capable of instantaneously uniting with the other two, so as to form one system in case of necessity from fire or public commotion.

It has long been a matter of surprise and regret, that while the electric telegraph extends itself over the length and breadth of the land, connecting the nearest and the remotest towns of the United Kingdom with the metropolis, its advantages have not hitherto been secured as a means of transmitting instantaneous intelligence between the numerous police and fire establishements, which have under their care the protection of life and property.

The immense destruction of property and the melancholy sacrifice of human life by fire, the poverty and distress consequent thereon, are subjects deserving the most serious consideration. The existence of such a ready and instantaneous means of procuring assistance in times of danger as the electric telegraph affords, would impart, as it were, a new feeling of security to the inhabitants of our large and densely populated towns.

The City of London, built as it is upon an undulating ground, is peculiarly favourable to the development of a system of over-house telegraphs. The plan has been successfully adopted in New York, Paris, Brussels, and many other large continental towns. In America, wires have been carried upwards of a mile without any intermediate support, and have now been in operation several years.

In advocating a plan of over-house telegraphs, I have no desire to depreciate the merits of the under-ground system, except on the score of expense, the difference in which respect is enormous, and the City would entail upon itself a perpetual source of annoyance to the public by its adoption. When the under-ground wires are injured or become impaired, it is difficult to find the exact locality where the mischief arises; but if any accident should befall the suspended wires, the injury could be immediately discovered and as speedily repaired. To replace an impaired wire would be only the work of an hour, while if it were under-ground, its repair would be a work of days, besides the annoyance of shopkeepers, and the interruption of traffic occasioned by opening the streets.

As to the *modus operandi*.—It being understood that on the appearance of the "fire" signal at either of the junctions the systems are to be immediately united, the same signal would instantaneously appear on the telegraph dials at every police and fire brigade station in the metropolis. The exact locality of the fire, its extent, the number of engines and police required, would be immediately transmitted to all or to particular stations according to circumstances. Should the fire be extinguished, notice could be sent, and the engines stopped, or they might be intercepted by the police, or by information to be obtained at any fire or police station on the way. False alarms could not, as at present, harass the brigade, or impose unnecessary trouble and expense in dragging out engines and fire escapes when not wanted.

When a fire breaks out now, the police, or any person who may happen at the time to be present, hastens to the nearest fire station, which may be a long distance from the scene of the conflagration, and then from the station messengers are again sent to all the others. Sometimes, at night, the reflection gives the alarm, and is the only guide, though too often a deceptive one, the firemen have to direct them to the spot where their services are required. All these proceedings occupy much time; and often, before the engines have arrived, the premises are entirely destroyed; in other cases, the fire has been subdued, and in others the alarm is found to be false. Nevertheless, engine after engine continues to arrive, to no purpose, when (and such has been often the case) other fires are raging in the very neighbourhood from which they have been unnecessarily withdrawn. The telegraph, as already observed, would be the means of concentrating at any required spot the whole power of the brigade; and the authorities at the chief fire station in Watling-street, or the chief police station in Old Jewry or Scotland-yard, would be enabled to regulate the movements of their men as accurately as if they were under their own eyes —a system which cannot fail to result in the saving of much trouble, expense, an immense amount of property and human life. It has been very truly observed, there can be no doubt that in many a half-hour, occupied by messengers, &c., a larger amount of property has been destroyed than would have paid for constructing a most efficient and complete telegraphic system, embracing the whole of the metropolis. Of the truth of this, the fire at Camden Town affords a ready illustration.

Although, to an observer, the working the telegraph may appear complex and difficult, it is in reality but a question of practice, as the young men upon the railways are very soon trained to transmit messages in an expeditious and accurate manner, in addition to their other duties.

Having thus endeavoured to point out the manner in which the electric telegraph may be beneficially and advantageously applied to the purposes above described, I sincerely trust that, however inadequate this attempt may be, the public will give the subject that fair consideration which its importance demands; feeling sure, that if the scheme is well considered, the day is not far distant when it must be carried out.

Carpenter's-hall, London Wall.

ALLEGED INFLUENCE OF SOLAR LIGHT ON COMBUSTION.

Some researches on this subject have lately been made by Dr. J. Le Conte, Professor of Natural Philosophy in South Carolina College, U.S., and the results were embodied in a paper* read before the American Association for the Advancement of Science. The following is an abstract of the paper:—

A popular opinion has long prevailed that the admission of the light of the sun to an ordinary fire tends to retard the process of combustion, and even ultimately to put it out. About thirty-two years ago Dr. Thomas M'Keever published a series of experiments in the "Annals of Philosophy" (new series, vol. 10, p. 344),

* American Journal of Science and Arts for November, 1857, p. 317.

which seemed to confirm this notion. Gmelin, in his "Handbook of Chemistry" (Cavendish Society's translation), vol. 2, p. 35, announces Dr. M'Keever's results without comment; and in Brewster's "Edinburgh Journal of Science" (vol. 5, p. 180, 1826), it is said, "It has always been considered a vulgar error that the sun's light extinguishes a fire, but the following experiments by Dr. M'Keever put the matter beyond a doubt."

Looking, however, at the important bearing which these experiments appear to have on the modern dynamical theory of the mutual convertibility of the so-called imponderables, Prof. Le Conte was induced to undertake a series of experiments to test Dr. M'Keever's conclusions. Dr. M'Keever's results are as follows:—

EXPT. 1.—Green Wax Taper lost in 5 minutes,

In Dark. Temp. 67°.	In Sunshine, Temp. 78°	Ratio.
9·25 grs.	8·5 grs.	1 : 1·088

EXPT. 2.—Taper lost, by burning 7 minutes, in

Dark, Temp. 67°	Sunshine, Temp. 78°	Ratio.
11 grs.	10 grs.	1 : 1·100

EXPT. 3.—Mould Candle, to consume 1 inch took, in

Dark, Temp. 68°	Sunshine, Temp. 80°	Ratio.
56m. 0s.	59m. 0s.	1 : 1·053

EXPT. 4.—Taper, to consume 1 inch took, in

Dark, Temp. 67°	Sunshine, Temp. 79°	Ratio.
4m. 30s.	5m. 0s.	1 : 1·111

EXPT. 5.—Taper in Sunshine lost in 10 minutes,

In Painted Lantern.	In Uncoated Lantern.	Ratio.
16·5 grs.	15 grs.	1 : 1·100

The *sixth* experiment, made in strong *moonlight*, indicated no diminution in the rate of consumption.

Dr. M'Keever concluded that solar light did exercise a retarding influence on combustion, and attributed the effect to the well-known influence of the solar rays in many chemical processes, the chemical rays being supposed to exercise a *deoxydising* power. Prof. Le Conte considered that the experiments of M'Keever were liable to error, owing to disturbances in the atmosphere when the experiments were conducted in the open air, and the difficulty of procuring precisely the same conditions in relation to the air supplied to the interior of the lantern. He therefore endeavoured to secure perfect calmness by performing all the experiments in a large lecture-room, with all the doors and windows closed. To secure exposure of the flame to the influence of intense solar light, without heating the atmosphere, he employed the reflecting mirror of a large solar microscope with the condensing lens and tube, and by this means a pencil of light was thrown on the flame, and traversed it without imparting a sensible amount of heat to the surrounding air. The rate of burning was determined thus:—

"A portion of candle, three or four inches in length, was secured to the bottom of one of the scale-pans of a tall balance and ignited. After allowing it to burn for ten or fifteen minutes, so as to secure a steady flame of constant size, it was *nearly* balanced by adding weights to the opposite scale-pan, allowing a slight preponderance to the candle-pan. In a short time the equilibrium was established by the burning of the candle; the precise *time* at which the balance indicated a condition of equilibrium was *accurately noted*. Next *a given* weight (say 60 or 100 grains) was withdrawn from the weight-pan, and the *time* of restoring the equilibrium by the loss of weight in the burning candle, was, in like manner, recorded."

The state of the barometer and thermometer were recorded, and the following table gives the result of three sets of experiments:—

Date.	Bar. reduced to 32° Fah.	Tem. of Air, Fah.	Time of consuming 60 grs.		Amount consumed in 10 min.		Difference.
			Dark.	Sunlight.	Dark.	Sunlight.	
		Degs	m. s.	m. s.	grs.	grs.	grs.
May 9...	29 92	67	26.24	26.15	22·73	22·86	−0·13
June 6...	29·72	75·5	28.39	28.45	20·94	20·87	+0·07
June 10..	29·62	84	28.55	28.51	20·75	20·80	−0·05

These experiments indicate *no sensible* difference in the rate of combustion, and are all the more remarkable, as it might have been expected, looking at Dr. M'Keever's experiments, that the effects would have been more marked when the light was increased in intensity by concentration from the lens. The difference on different days shows the effect of slight alterations in external conditions, namely—1st, barometric pressure; 2nd, temperature of the air; and 3rd, the amount of aqueous vapour present.

1st. Barometric pressure. On the authority of Sir Humphrey Davy,* Mons. Friger, a French civil engineer, engaged in conducting certain mining operations† in which it became necessary to work in condensed air, and Mr. J. Mitchell, whose experiments on the rate of combustion of the fuses of shells in high altitudes were lately given in a letter to the Royal Society,‡ Prof. Le Conte concludes that the process of combustion is *retarded* by a diminution in the density of the air, while it is *accelerated* by its condensation.

2nd. Temperature of the air. On this point Professor Le Conte considers that the information is meagre, the experiments of Grotthuss and Sir H. Davy being contradictory in their results, and the effect of the "hot blast" not being applicable in the present case, the air in that case not being in its *natural state* of density, and the increase of temperature being due to the fact that less heat is carried off in the process of combustion. In the absence of direct experimental evidence, Professor Le Conte, reasoning on well-known physical principles, that increase of temperature is equivalent to diminution of barometric pressure, concludes that it tends to retard combustion, and, further, that if the temperature of the flame be *constant*, then the *draught*, which will be dependent on the difference between the temperature of the flame and that of the surrounding atmosphere, will be diminished in warm air, and, hence, combustion will be *retarded*. It is, however, possible that augmentation of temperature might tend to accelerate combustion by favouring the liquifaction of the wax, and thus facilitate the oxydation of the combustible matter.

3rd. Amount of aqueous vapour present. It is obvious that the presence of aqueous vapour can only tend to *retard* the process of combustion, and Professor Le Conte refers to Sir H. Davy,§ M. Deijardin,|| of Lile, and Mr. David Waldie.¶

Professor Le Conte unfortunately did not observe the hygrometric conditions of the air during his experiments, hence, these are, of necessity, thrown out of consideration. In Dr. M'Keever's experiments barometric indications are not given, nor is it known how many were performed in one day, whilst in Professor Le Conte's the data for estimating the combined influence of pressure and temperature are given.

Professor Le Conte then proceeds to estimate, on the assumption that Dr. M'Keever's experiments were made on the same day, the adequacy of *temperature*, to account for the difference in the rate of burning, and from the great discrepancies in the ratios, he concludes that there must have been some disturbing cause vitiating the accuracy of the experiments. Temperature alone is not sufficient to account for the diminished rate of burning. He then discusses his own experiments to ascertain if

* "Researches on Flame," Philos. Trans., 1817, p. 45, and Works of Sir H. Davy, edited by John Davy, vol. 6, p. 57.

† Comptes Rendus, Tome 13, p. 884. Annales de Chimie et de Physique, 3d Series, p. 234. The following are the words of M. Triger, "A la pression de trois atmosphères, cette accélération devient telle que nous avons été obligés de renoncer aux chandelles à mèches de coton pour les remplacer par des chandelles à mèches de fil. Les premières brûlaient avec une telle rapidité, qu'elles duraient à peine un quart d'heure, et elles répandaient en outre une fumée intolérable."

‡ Philosophical Mag., 4th Series, vol. 10, p. 48.

§ Phil. Trans., 1817, p. 65.

|| Comptes Rendus, Tome 5, p. 28, also Tome 35, p. 368.

¶ Philos. Mag., 3rd Series, vol. xiii, p. 86.

rapidity of burning on *different* days varies according to the combined effects of barometric and thermometric oscillations, and he finds that the rate of combustion increased in a higher ratio than the density of the air, and hence concludes that some other agency must have operated in these cases.

In discussing Mr. Mitchell's experiments, he finds that the augmentation in the rate of burning increases in a somewhat higher ratio than the density of the air, while the contending influence of atmospheric density in the phenomenon of combustion is clearly demonstrated.

Professor Le Conte concludes his paper by saying,—

"From the foregoing discussion it is evident that the subject demands a thorough experimental investigation, with a minute attention to all of the external conditions which may influence the results. This I propose to undertake during the next twelve months. In the mean time it is hoped that these preliminary researches may prepare the way for a clearer appreciation of the difficulties which are to be encountered. Perhaps, however, in the present stage, we may be warranted in deducing *two* conclusions; 1st, that *solar light does not* seem to exercise any sensible influence on the process of combustion; and 2ndly, that variations in the *density of the air do exert* a striking effect in retarding or accelerating the rapidity of the process, the rate of burning augmenting with every increment of density and *vice versa;* but the exact ratio between them remains to be determined."

COPPER IN THE SEA.

The following is extracted from the *Scientific American:*—

Some five years ago, two French chemists demonstrated that the ocean contained a notable portion of silver. Recently these and other philosophers have again been at work upon the same subject; following it up, however, much more closely, they now tell us that, calculating the whole ocean, it cannot contain less than two millions of tons of silver in solution. The truth of this statement is verified by experiments tried at various parts of the world—one more famous than the rest by Mr. Field, an English chemist, who lives at Coquimbo, in Chili. The water he analysed was taken from the Pacific Ocean, and afforded the same result as that which the French chemists obtained from the water taken off St. Malo, France, in the English Channel. That the ocean should contain minute portions of every substance of the globe that is soluble in saline water is not surprising; therefore we are, in a measure, prepared for the further discovery that the "old grey beard," ocean, contains also an enormous quantity of copper—a fact recently proved in the laboratory of Mr. Septimus Piesse. The beautiful blue colour of portions of the Mediterranean Sea is due, he says, to an ammoniacal salt of copper, while the greenness of other seas is owing to the chloride of copper. The method of extracting silver from the sea is one of simple affinity. Granulated copper being suspended in the "briny waves," any silver salt that is contained therein is decomposed, a portion of the copper is dissolved, and the silver is precipitated thereon, from which it is afterwards parted by the usual means adopted in every laboratory. By a happy analogy, Mr. Piesse separated copper from the sea by the same process. His experiments were performed between the ports of Marseilles, on the French Mediterranean coast, and Nice, in Sardinia. A bag of nails and scrap iron was suspended at the side of the steamer which plies between these places, and after the first voyage (about twelve hours), copper was indicated to be present on the iron. Four separate voyages, however, were made before the bag of iron was removed to the laboratory; then the quantity of copper was found to be so great that much surprise was shown that the presence of this metal had not been previously discovered, especially as the action of sea water on ships' bottoms has long been known. Mr. Piesse is continuing his experiments.

SOUTH KENSINGTON MUSEUM.

During the week ending 19th December, 1857, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,660; on Monday and Tuesday (free evenings), 3,767. On the three students' days (admission to the public 6d.), 530. One students' evening, Wednesday, 125. Total, 7,082.

Home Correspondence.

FOOD GRAINS.

SIR,—All the writers on this subject seem to be very much mystified when the hard wheats of the warmer climates come under consideration in respect of their value as a material for the production of flour.

Hard wheat, properly so called, is never made use of by the natives for the production of flour in a separate form, nor can flour be made from it except under certain circumstances.

The primary use of hard wheat is that of grinding it into *semolina* for the manufacture of *macaroni*, which is never made from flour. When a grain of hard wheat is dissected, no flour, or the material of which it is made, is found in the interior, the whole of its substance being composed of a semi-transparent horny matter, easily convertible into *semolina* by rather coarse grinding.

When hard wheat is to be ground into flour, it is only used in a mixture composed of the following articles, in nearly equal proportions, viz., soft wheat, hard wheat, barley, broad beans, from the coast of Barbary, Indian corn, horse beans, field peas, vetches, &c., &c.

The mixture is ground in powerful water-mills, that is, those that have heavy hard millstones, sharply dressed, and capable of grinding the whole of such a heterogeneous composition, cuticle included, into tolerably fine flour or meal, with very little bran in it, and that not always sifted out.

The bread made from such flour rises well, and is very nutritious and sustaining, but it is very dark, sometimes almost black, and is universally the food of the farmer and his labourers, and others of that class.

I am, &c., HENRY W. REVELEY.

COAL AND COKE.

SIR,—The very interesting discussion arising out of Mr. Apsley Pellatt's paper, "On the Comparative Heating Powers of Coal and Coke," appears to be profitably continued in the Society's *Journal*. Among the communications on this subject, in yesterday's number, I find a letter from Mr. Henry W. Reveley. There are so many sound views taken in that letter, that I regret having to object to any. The writer, however, quoting from my "Prize Essay," appears to have so mistaken my views on some points, and even to have somewhat severely commented on the same, that I request permission to put the matter right before the Society.

Mr. Reveley says, "In the well-known 'Prize Esssy' on this subject, by Mr. C. Wye Williams, there is scarcely an allusion to the subject of ashpits, and none whatever to the possibility of half the mischief being caused by their very faulty construction." So far, however, from that being the fact, among "the respective *duties* which each part of a furnace or boiler has to perform," the second head for examination is, "of the ashpit and the area below the fuel," the first being, "of the chamber of the furnace and the area above the fuel."

Treating of the area in the chamber of the furnace, I have dwelt on the "chemical and mechanical reasons for providing an enlarged chamber." As a practical rule, I have even given the required proportions, and have commented strongly on the want of adequate space. On the

next head, "the area of the ashpit below the fuel," I commented on the similar error which prevails in improperly making the ashpit "long and shallow." I then observed that what was said with reference to the ill-judged proportions of the chamber above the fuel, was equally applicable to the ashpit below it, to avoid the mere repetition of the same reasons, adding, "the object being to enable the air to rise with a moderate velocity, equally, to all parts of the fuel and bars." It does not appear possible more adequately to comment on the want of due proportions in the ashpit and the means of correcting them.

The writer then adds, "Mr. Williams acknowledges that the Cornish system of firing is essentially the most economical in the evolution of heat from a given quantity of fuel in a given time, yet insists on the necessity for building and setting our furnaces and boilers on faulty and erroneous principles, and then curing the evils produced by means of costly patent inventions, which seldom, however, meet with success." I am at a loss to conceive how the writer could have so entirely mistaken my views. I need only say they are the reverse in every particular of what he has imagined them to be.

I have shown how the furnaces and boilers should be constructed, and this method, in the experience of many years, and numerous land and marine boilers, has never failed. As to the use of "costly patent inventions," I have shown that no patent inventions are required, and that such as are costly should be particularly avoided, the cost being generally the result of mechanical appliances which are either unnecessary or injurious.

Mr. Reveley then adds: "Singularly enough, Mr. Williams goes on to state that the excellence of the Cornish system is at the expense of time, space, and first cost of boilers." The first item, expense of time, he observes, is "incomprehensible, for all boilers must, of necessity, furnish a given quantity of steam, at a given pressure, and in a given time." Now, this is directly begging the question, since he does not define either the quantity, pressure, or time; and it is well known that one of the Cornish boilers does not produce one-half the quantity of steam that a boiler of similar proportions does on the Lancashire system, by reason of the slow combustion adopted in the former, and the rapid combustion in the latter.

The principle of the Cornish system is slow combustion, with thin and frequent firing. By this means, as shown in the prize essay, no more gas is evolved on each square foot of furnace than can be effectively supplied with air, and its perfect combustion thereby insured. Here, then, economy is obtained at the expense—that is—the expenditure, of time. In illustration, take the following carefully-performed experiments, to test the Cornish system of slow combustion as opposed to the rapid combustion in marine steam-boilers:—

	Coal used per hour.	Water evaporated per hour.	Water evaporated per lb. of coal.	Ditto, from 212°	Pyrometer heat in flue.
Slow Combustion (as in Cornwall)	149 lbs.	1425 lbs.	9·56	11·58	810°
Quick Combustion...	262 lbs.	2534 lbs.	9·45	11·45	1212°

Here 1425 lbs. only of water were evaporated in the hour, whereas, by more rapid combustion, 2534 lbs. were evaporated in the same time. The difference in the weight of fuel used will shew the saving, at the expense of time. To compensate this, in Cornwall a second boiler would be provided.

"Expense of space," Mr. Reveley considers as "absurd," nevertheless, if slow firing and long boilers were adopted in our steam ships, it is self-evident the expense or loss by the requirement of so much additional space would be an irremediable evil.

Mr. Reveley overrates the value of large boilers, when he says, "boilers that do not require forcing, or hard firing, will last out, perhaps, ten times those that require such treatment." Now, hard firing is the adopted system in steam navigation with smaller boilers, to save the expenditure and waste of *time* and *space*, yet, 8 years is about the average life or durability of our boilers. This would, according to Mr. Reveley, give a long life of 80 years to a Cornish boiler.—I am, &c.,

C. WYE WILLIAMS.

Liverpool, Dec. 19th, 1857.

AGRICULTURAL IMPLEMENTS.

Sir,—On the perusal of Mr. S. Sidney's paper, lately read before the Society of Arts, there appear several things which require notice.

The first in order is the comment upon Scotch agriculturists and their "barbarous implements." The Scotch ploughs are not made in England, but were originally made in Scotland, and are still extensively manufactured there; and, as an instance, I will just say that Messrs. John Gray and Co., of this place, the original makers of the iron Scotch plough, are now sending into England and Ireland, and exporting, about two thousand of these ploughs annually, besides the demand for home (Scotch) use. The Scotch plough has been copied by English makers, who, to secure a portion of the trade, acknowledge its origin by the name.

The Scotch threshing machines are as effective on the corn as the English, and are also home-made, though principally, if not altogether, on Meikle's original plan—threshing clean but breaking the straw. This plan *originally* comprised threshing drum with feeding rollers, shakers, riddle, elevators, fan and dressing apparatus, in effect nearly the same as the plan now in use in English combined machines. These parts were copied only singly by the English makers; and the "mere box for beating out the corn in a rough way," was a part of the combination which was altered before the other parts, also altered, were applied to it by the southern machine makers. The threshing machine is essentially of Scotch invention, Scotch adoption, and many are yet made slightly modified from the old model.

Will Mr. Sidney be kind enough to say how the "whites," so long the bane of the machine maker or agricultural engineer, are so effectually extracted and separated from the grain, and the market price of this? If he will, I am sure he will solve a problem long sought to be unravelled, and but just accomplished by shelling, or beating, or rubbing by means of patented appliances. I have generally found them in "best corn," and not in the "tail corn."

Again, 100 to 150 quarters, or 130 to 200 bolls of corn, is above the average quantity of best corn obtained from a day of 10 hours threshing; say, rather, 60 to 80 quarters, or 80 to 110 bolls, at a cost of 1s. 3d. to 1s. 6d. per quarter, or 1s. to 1s. 2d. per boll.

Mr. Sidney seems to have a very imperfect knowledge of Meikle's machine, and the present Scotch machine or mill as it is called. The great argument against machine threshing was, and, to a great extent, still is, the breaking of the straw; flail threshing, the use of that "antiquated instrument of stupefaction" is still continued in the "best cultivated counties," in Oxfordshire, and more particularly in the metropolitan counties, and in the immediate neighbourhood of large towns, because the straw, thus treated, commands a better price for packing and other purposes; it also produces the best barley for malting, which is very frequently thus threshed. The flail is not gone into disuse, but may be still found at work, as also hand-sowing.

In speaking of steam-engines, the firm of Clayton, Shuttleworth, and Co., is put prominently forward, and the names of those who were more forward in date in the production of portable engines omitted. The names

of Howden, Tuxford and Dean, the pioneers of the engines, surely deserve a passing word as much as Tull, Menzies, and others; but I, in common with others, am much surprised at the entire omission of Tuxford's name, the firm which has, for nearly three years, held the chief prize for these engines, and whose make of engine is distinct from any other. The name of the town of Boston, too, was not thought worthy to be given with the others,—the birth-place of the portable engine and portable steam-threshing machine. What has a railway or telegraph station to do with portable engines, whose portability and readiness of application to any purpose where steam-power is applicable, are available in any place? Fixed barn works may be influenced by this cause, in the expense of carriage, but not portable engines and other portable machines.

If Mr. Sidney had paid a little more attention to "antiquarian curiosities" and "mechanical toys," some errors might have been avoided in his paper, as also the charge of mentioning certain parties and omitting others. The steam horse of Boydell, and the cultivator of Romaine, the rotary plough of Usher, the ploughing system of Williams, and the high-pressure engine of Collinson Hall, are "mechanical toys" deserving notice, mechanical in their details and realised facts, yet entirely omitted.

Opinions have been lately invited and freely given as to the prizes offered by the Royal Agricultural Society, and if this Society has been the means of raising "small blacksmiths into large engineers," Mr. Sidney may rely upon it that the judges would never have awarded prizes to their productions without satisfying themselves that the implements were required and were the best of the kind. Witness his own remarks on Crosskill's clod-crushers.

While touching upon haymakers and other implements, he omits all mention of mills; surely this was an oversight, as they are among the most useful implements of a farm.

The remark about the plough, seen while hunting in Essex, would have been better omitted. Perhaps, as a straggler, he had time to examine the mode of culture and tools employed; at any rate, if he sums up his knowledge of agricultural implements at present as he has done, and gives that as containing his opinions, I beg leave to refer him for some further information to some papers of mine read before the Institution of Mechanical Engineers at Birmingham last year, and this, on the application of steam-power to agricultural purposes, where he will find facts and results that may surprise him; or, perhaps, the forthcoming work on the machinery of the farm, by Stephens, may be worth a place in his library.

For the Scotch, I claim the invention of the threshing machine (combined) and the Scotch plough. To these Mr. Caird has added the horse hoe and reaping machine—may I also add the steam plough?

I must apologise for intruding my remarks upon your notice, but believing that some reply was called for, I venture to solicit a place for this in your *Journal*, and I am, &c., WILLIAM WALLER.

Uddingston by Glasgow, Dec. 14, 1857.

Proceedings of Institutions.

DARLINGTON.—In order to raise funds for the purchase of new books, the committee of the Mechanics' Institution organized a grand soirée, which took place in their hall on Tuesday, the 1st of December. About 350 attended. Messrs. Pease, F. Mewburn, junr., and other friends contributed pictures and engravings. The Government School of Art sent examples of their successful pupils, and Mr. Shennessey, gardener to John Harris, Esq., decorated the room with garlands. About twenty-eight ladies and friends of the Institute contributed the repast, and many of the former assisted at the tables. £17 13s. 6d. was taken at the door. The Darlington Philharmonic Band lent their services for the occasion. Henry Pease, Esq., M.P., President of the Institute, occupied the chair, and delivered an introductory address, treating generally on the past history and present objects of the Institution. He then called upon the Rev. J. G. Pearson, who spoke of the benefits resulting from Mechanics' Institutions, and the remarkable progress made by them of late years in public estimation. He was followed by Captain O'Brien, who spoke to a similar effect. Mr. Francis Mewburn, junr., then addressed the meeting, dwelling especially upon the connection of the Institution with the Society of Arts, and giving an outline of the history of that Society. Mr. Mewburn enlarged upon the advantages resulting from the Society's Examations, and explained the system as set forth in the programme just issued. Mr. Joseph W. Pease, and Mr. F. L. Kipling, then addressed the meeting, which separated after passing the usual votes of thanks.

HOLBECK (NEAR LEEDS).—On the 24th November, a lecture, on Durham Cathedral, was delivered before the members of the Church Institute, by the Rev. N. Greenwell, B.A. The history of this venerable and stately pile was traced, by the lecturer, from the earliest period down to the death of Bishop Van Mildert. The lecturer described the building as having been founded in 1093. Its length, including the western porch, is 507 feet, and its greatest breadth 200 feet. It has a central tower 214 feet in height, a fine west front, with a Galilee chapel, and two richly ornamented towers 143 feet in height. The lecture was illustrated by a ground plan and elevation of the edifice, and every portion of the building was briefly described. Mr. Greenwell gave a description of the funeral of the last Prince Palatine, of which he was an eye-witness. Some well executed drawings of the Old Monks, St. Cuthbert's Banner, and the cruel Earl Cassilis, added considerably to the interest of the lecture. The attendance of members and friends, notwithstanding the unfavourable state of the weather, was remarkably good.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Dec.* 18, 1857.]

Dated 11th August, 1857.

2147. Richard Husband, Manchester—An improvement in the manufacture of hats.

Dated 2nd November, 1857.

2784. James Apperly and William Clissold, Dudbridge, Gloucestershire—Improved means of and apparatus for feeding fuel to furnaces.

Dated 3rd November, 1857.

2794. Anthony Charles Sacré, Brussels—An improved apparatus for measuring water.

Dated 25th November, 1857.

2942. Frédérique Lemaire, Tavistock-street, Covent-garden—An improved petticoat for ladies' wear. (A communication.)

2944. Frederick Herbert Maberly, Stowmarket, Suffolk—An improved general polishing machine or apparatus.

2946. Camille Bernard, 39, Rue de l'Echiquier, Paris—Certain improvements in heating apparatus. (A communication.)

2948. Edmund Charles Tisdall, Holland Park Farm, Kensington—Improvements in the mode of preserving animal and vegetable fluids, and fluids containing animal and vegetable substances.

Dated 26th November, 1857.

2950. William Blinkhorn, Sutton, near Saint Helen's, Lancashire—Certain improvements in machinery or apparatus for grinding and smoothing, and for polishing glass.

2952. John Frederick Shoner, 4, Church-street, Kennington—Improvements in common road carriages.

2954. Joseph Ruston and James Toyne Proctor, Lincoln—An improved arrangement of machinery for dressing grain.

Dated 27th November, 1857.

2956. William Bowers Taylor, Ballymena, Antrim, Ireland—Improvements in driving looms for weaving.

Dated 28th November, 1857.

2960. Benjamin Peach, Leicester—Sundry improvements in bedsteads, elastic bed bottoms, the seats of chairs, sofas, and other similar articles. (A communication.)

2964. Antoine Alphonse Chassepot, Paris—Improvements in breech-loading fire-arms.

2966. Robert Tindall, junr., Fraserburgh, Aberdeen—Improvements in harpoon guns and ammunition.
2968. Frederic Groom Grice, West Bromwich, Staffordshire—New or improved machinery for the manufacture of bolts, spikes, rivets, screw blanks, and other articles of like manufacture.

Dated 30th November, 1857.

2970. John Nichols, Pendleton, near Manchester—Improvements in machinery or apparatus used for sizing yarns or threads.
2972. Thomas Kaye, Grange-moor, Whitley-lower, near Dewsbury—Improvements in looms for weaving.
2974. Pierre Ambroise Moutel, Paris—An improved motive power.
2976. Daniel Kinnear Clark, 11, Adam-street, Adelphi—Improvements in furnaces for promoting the combustion of fuel without smoke, and the communication of heat, especially adapted to steam boilers.
2978. James Howard, Bedford—Improvements in the construction of ploughs.
2979. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for cleaning carpets and other fabrics. (A communication.)
2981. Simon Solomon, Wood-street, Spitalfields—Improvements in umbrella, parasol, and walking sticks or canes.

Dated 1st December, 1857.

2983. Frederic George Spray, London—Improvements in the manufacture of gunpowder.
2984. Richard Hipkiss and William Olsen, Birmingham—Improvements in lubricating shafts and axles, and other articles requiring lubrication.
2985. Denny Lane, Cork—Improvements in lighting, regulating, and extinguishing street and other gas lamps by means of electricity.

Dated 2nd December, 1857.

2987. Edward Clarence Shepard, Jermyn-street—Improvements in magneto-electric machines.
2988. John Summers, Stalybridge, Cheshire, and David Wormald, Dukinfield—Improvements in machinery for manufacturing clog irons, and heels and tips for boots or other coverings for the feet.
2989. Joseph Eccles, Blackburn—Improvements in drying and colouring, or ornamenting bricks, tiles, pipes, and other articles made of plastic earths.
2990. Joseph Hetherington, Birmingham—A new or improved manufacture of the bowls of castors for furniture.
2991. William Bird and Richard Ashton, Blackburn, and Thomas Bird, Manchester—Improvements in looms and pickers for looms.
2992. William Thomson, Dalkeith-park-gardens, Mid Lothian, N.B.—Improvements in machinery or apparatus for propelling ships or vessels.
2993. Charles Jean Michel Moireau, 23, Avenue de la Porte Maillot, Passy, near Paris—A composition to be used as a substitute for bees' wax.
2994. John Fowler, jun., 28, Cornhill, and William Worby, Ipswich—Improvements in apparatus used when ploughing, tilling, or cultivating land.
2995. Joseph Francis, United States, and Charles Manby, Great George-street, Westminster—Improvements in the manufacture of waggons and other vehicles, applicable to the transport of troops and military and other stores on land and water.
2996. Alexander Parkes and Henry Parkes, Birmingham—Improvements in the manufacture of sheathing metals.
2997. John Livesey, New Lenton, Nottingham—Improvements in the manufacture of pile fabrics, and in the machinery employed therein.

Dated 3rd December, 1857.

2998. Louis Frederic Ernest Ciceri, 38, Rue Pigale, Paris—Improvements in the preparation of white as a basis of colour.
2999. George Tomlinson Bousfield, Loughboro'-park, Brixton—Improvements in collapsible boats. (A communication.)
3000. Robert Hazard, Thanet-place, Temple-bar—Improvements in a self-acting reclining chair or couch.
3001. Elijah Slack, Glasgow—Improvements in the treatment, application, and use of wheat and other grains and amylaceous vegetable substances.
3002. John Reeve, 46, Rutland-gate—Improvements in propelling vessels.
3003. Charles Henwood, Oxford—An improved arrangement of galvanic battery suitable for medical purposes.
3004. William Parsons and James Attree, Brighton—An improved cock or tap and flushing apparatus.

Dated 4th December, 1857.

3005. James Buchanan, Liverpool—Improvements in smoke-consuming apparatus, applicable to boiler and other furnaces.
3006. Abraham Ripley, Saint Helens, Lancashire—Improvements in mills for grinding myrabolams, valonia, bark, and other similar substances.
3007. James Hamilton, Halifax—Improvements in the construction of "strained wire fencing" for dividing fields, parks, and pleasure grounds.
3008. Henry Deacon, Woodend Chemical Works, Widnes Dock, near Warrington—Improvements in the manufacture or production of soda and potash.
3009. John Rubery, Birmingham—Certain jmprovements in the manufacture of umbrellas and parasols, and in the application of a new condition of material to the production of some of the parts thereof that has not heretofore been used for that purpose.
3010. Julien d'Helle, and Albert Viscount de Waresquiel, Paris—Improvements in railway rolling stock.
3011. Samuel Henry Sewers, Curry Rivel, Somerset—An improved powder for dusting turnips, and machinery for distributing the same, which may be employed for similar and useful purposes.
3012. Joseph Grizard, Nevers, France—Improvements in watches, and in the means of or for winding up and setting watches.
3013. Wm. Standring, Bury-road, Rochdale—An improved throstle and mule spring for the under clearers of spinning machines.
3014. Alexander Morton and James Howden, Glasgow—Improvements in obtaining motive power.

Dated 5th December, 1857.

3015. Stanislas Jules Count Ostrorog, Paris—A wind musical instrument.
3016. William Caldwell, Liverpool—An improved fluid meter, which may be used as a motive power engine.
3017. Marc Antoine François Mennons, 39, Rue de l'Echiquier, Paris—Improvements in lucifer matches. (A communication.)
3018. William Mercer, William Bodden, and William Higginson, Oldham—Improvements in certain parts of machinery for slubbing and roving cotton.
3019. Thomas Sidebottom Adshead, and Abraham Holden, Northend, near Stalybridge, Cheshire—An improved self-acting combination of machinery for the grinding of carding engine rollers.
3020. William Thomas Henley, 46, St. John-street-road—Improvements in ropes and cables for telegraphic or other purposes, and in machinery used in the manufacture of such and other ropes and cables.
3021. John Brinton and James Crabtree, Kidderminster—Improvements in the preparation of weft yarn to be used in the manufacture of carpets and other pile fabrics.
3022. James Sinclair, Hill-street—Improvements in machinery or apparatus for cutting or dividing stone and marble.
3024. William Edward Newton, 66, Chancery-lane—Certain improvements in apparatus for laying submarine telegraphic cables. (A communication.)

Dated 7th November, 1857.

3025. Daniel Hiley, Percival Hiley, William Hargreaves, and Enoch Haley, Bradford—Improvements in power looms for weaving worsted, cotton, silk, woollen, and other fibrous substances.

WEEKLY LIST OF PATENTS SEALED.

December 18th.

1701. George Pemberton Clark.
1709. Horace Hollister Day.
1713. Thomas Spencer.
1717. Horace Hollister Day.
1721. Edward Kirk, James Leadbetter, and Chas. Wilson.
1724. Samuel Fox.
1726. Samuel Fox.
1728. Benjamin Richardson.
1735. William Edward Newton.
1741. John Norris, jun., and G. Worstenholm.
1742. Sir Frs. Charles Knowles, Bart.
1759. Richard Morcom.
1775. Edouard Besnier de la Pontonerie.
1781. Josiah Wright, A. Wright, and Francis Roberts.
1789. William Price Struvé.
1809. Arsène Auguste Olivier.
1810. George Swindells and Jonathan Arnold.
1811. John Carter and Brook Hodgson.
1815. Samuel Nye.
1845. Charles Orphin and Edward Lyons.
1853. Joseph Lockett and William Watson.
1855. Alexander Angus Croll.
1871. Thomas Bowden.
1918. Thomas Vicars, senr., Thomas Vicars, junr., Thomas Ashmore, and Jas. Smith.
2085. Antoine Galy-Cazalat and Adolphe Huillard.
2343. James M. Miller.
2433. Arthur Rigg, senr., and Arthur Rigg, junr.
2505. Samuel Clarke.
2587. Fennell Herbert Allman.
2695. Thomas Hamilton and Jas. Hamilton.

December 22nd

1746. William Knapton.
1748. William Symons.
1754. Joseph Scipion Rousselot.
1755. Rd. Archibald Brooman.
1762. Charles Fréderic Vasserot.
1765. John Juckes.
1768. Charles Sanderson.
1776. Charles Grafton Page.
1777. John Talbot Pitman.
1779. William Green.
1782. Elijah James Crocker.
1783. John Ingham, Ed. Ingham, and Benjamin Ingham.
1787. William Palmer.
1793. John Lloyd, M.D.
1796. William Parsons.
1797. Benjamin Nichols and Samuel Ledward.
1805. Charles Thurber.
1807. Richard Howland.
1812. William Edward Newton.
1819. John Forster Meakin.
1829. Andrew Spottiswoode.
1830. William Pole.
1849. William Rowan.
1850. William Rowan.
1862. John Agar and William Agar.
1905. Charles Patrick Stewart and David Graham Hope.
1923. John Gill.
1944. Peter Rector Smith, M.D.
1976. Guillaume Defis.
1987. Samuel Ramsden.
2227. Henry Hodges.
2500. Stephen Smith.
2623. Edward Keighley.
2647. Richard Wright.
2739. Elizabeth McDowall.

Patents on which the Stamp Duty of £50 has been Paid.

December 14th.

2763. Bernard Hughes.

December 16th.

2688. Robert Walker.
2694. Henry Render.
2710. Felix Marie Baudouin.
2719. Warren De la Rue.

December 17th.

2666. Louis Henri Frederic Melsens.
2668. John Henry Johnson.
2684. William Milner.

December 18th.

2702. John Hunt.

Journal of the Society of Arts.

FRIDAY, JANUARY 1, 1858.

COPYRIGHT IN FINE ART.

A Committee on this subject has been appointed by the Council, consisting of Jacob Bell, F.L.S., John Bell, D. Roberton Blaine, F. S. Cary, A. E. Chalon, R.A., A. Claudet, F.R.S., Henry Cole, C.B., D. Colnaghi, David Cox, junr., H. Darvill, C. Wentworth Dilke, George Thomas Doo, R.A., Wm. Dyce, R.A., Sir Charles Eastlake, P.R.A., James Fahey, Roger Fenton, Wm. Fladgate, George Godwin, F.R.S., Lewis Haghe, Wm. Hallowes, S. A. Hart, R.A., J. R. Herbert, R.A., F. Y. Hurlstone, President of the Society of British Artists, Owen Jones, J. P. Knight, R.A., R. S. Lander, President of the National Institution of Fine Arts, John Leighton, J. F. Lewis, President of the Society of Painters in Water Colours, J. Linnell, D. Maclise, R.A., Wm. Mulready, R.A., Matthew Noble, F. R. Pickersgill, R.A., R. Redgrave, R.A., Sir Wm. C. Ross, R.A., George Scharf, junr., John Scott, Bell Smith, Fred. Tayler, Wm. Tooke, F.R.S., E. M. Ward, R.A., H. Warren, President of the New Society of Painters in Water Colours.

The Committee has met twice. At its first meeting, on the motion of the Chairman of the Council, Sir Charles Eastlake, P.R.A., J. Lewis, Esq., President of the Society of Painters in Water Colours, and D. Roberton Blaine, were unanimously chosen respectively Chairman, Deputy Chairman, and Reporter of the Committee.

The following resolutions have been passed by the Committee:—

Resolved,—That the enquiries of this Committee be directed,—

1. To ascertain the existing laws of British Artistic Copyright, and the chief defects of those laws.
2. How those defects affect the interests of producers of Works of Art.
3. How they affect the interests of purchasers of Works of Modern Art.
4. How they affect the interests of the public and the promotion of the Fine Arts.
5. How they affect the subjects of those Foreign States with whom Her Majesty has entered into International Copyright Conventions, and the laws of those States as affecting Artistic Copyright.
6. To obtaining instances of fraudulent or wrongful acts relating to Works of Modern Art.
7. And lastly, to suggest such remedies as appear best calculated to amend the defects of our Artistic Copyright laws.

Resolved,—That copies of the Resolution now passed be distributed to such societies and individuals as may be suggested by the Committee, it being understood that, with the exception of No. 6, the various points will be made known, in order to show to what objects the Committee propose to direct their attention, and that as regards No. 6, full and distinct answers will be requested.

PURCHASE OF THE SOULAGES COLLECTION.

The Council have acceded to the request to hold meetings in the Society's rooms, preferred by an Association of Art trades, which has been formed to urge upon Government the necessity of securing the Soulages Collection for the improvement of the decorative manufactures of this country. This association consists of the Mayors of Manchester, Birmingham, and other towns, and of the most eminent art manufacturers both in London and the provinces. Mr. J. G. Crace is the Honorary Secretary, and will receive any correspondence on the subject.

DETECTION OF VEGETABLE SUBSTANCES MIXED WITH COFFEE FOR PURPOSES OF ADULTERATION.

The following are the results of investigations made by Professor Graham, Dr. Stenhouse, and Mr. Dugald Campbell, and embodied in a report made by them to the Board of Inland Revenue. Their remarks apply to coffee in a roasted state, as it is in that condition alone that it is made use of. The roasting gives new properties to the bean. The woody tissue of the fresh bean is horny, and differs from ordinary woody fibre in its composition, and is also said not to yield sugar when treated with sulphuric acid. By the roasting, this woody tissue undergoes a partial decomposition, and becomes friable, and the difficulty of pulverising the seed, and exhausting it by water, is removed. There is produced at the same time a soluble brown bitter matter, due in part to a gummy substance pre-existing in the coffee, altered like starch by torrefaction, but principally to the conversion into caramel of a quantity of sugar in the coffee-bean, amounting to 6 or 7 per cent. of its weight. In addition to this there is the aroma produced by the roasting, arising from a brown oil termed Caffeone, so powerful as that a quantity which is almost insensible will aromatize two or three pints of water. There appears to be no seed which when roasted and ground forms a true equivalent and sufficient substitute for coffee, either physiologically or chemically. A great variety of seeds were tried in France, as substitutes for coffee, during the continuance of the continental blockade, including, in addition to maize, barley, oats, and the other cereals, the seeds of the yellow flag (*Iris pseudo-acorus*), grey pea (*Cicer arietinum*), the milk vetch, or Andalusian astragalus (*Astragalus boeticus*), the *Hibiscus esculentus*, holly, Spanish broom, acorns, chesnuts, the small lupin (*Lupinus angustifolia*), peas, haricots, horse-beans, sunflower, pips of the gooseberry and grape, eglantine (*Rosa villosa*), and the capsules of box (*Buxus sempervirens*). Of the seeds enumerated, the yellow flag, a common marsh plant in England, appears to have offered the only similarity to coffee; but it is doubtful whether the resemblance extended beyond the aroma of this seed when roasted, which is certainly suggestive of coffee. The search made among the seeds of other plants for a substitute for the coffee-berry may then be said to have entirely failed. The root substituted differs still more widely from true coffee, except in one property, namely, sugar. The roots most used have been those of chicory (*Cichorium intybus*), carrot, beet, rush-nut (*Cyperus esculentus*), earth-nut (*Arachis hypogœa*), scratch-weed (*Gallium aparine*), fern (*Polypodium filix mas*), and butchers'-broom (*Ruscus aculeatus*). These roots are more generally used as additions than as substitutes. It is to their all containing sugar, easily caramelized by heat that their use may be attributed. This flavour of burnt sugar appears to be a general favourite in our beverages. No one of these roots con-

tains any constituent which associates it with coffee except sugar. Chicory contains 30 per cent. of sugar. It was first introduced into use in Holland in 1801, and it is now used largely on the Continent and in England. Six million kilogrammes are known to be used annually in France. In dealing chemically with infusions, with a view to ascertain the proportion of pure coffee in a mixture, there is considerable difficulty, for although the presence of caffeic acid and caffeine can readily be detected, yet the discrimination of the exact quantity is both difficult and tedious, besides which different qualities of coffee contain different proportions of these substances. The general properties of an infusion are readily observed, and a single character in some instances, and two or three in others, are generally sufficient to detect adulteration.

1. When hot water is applied to the powder of chicory and other roots, it softens immediately, from the facility with which water is imbibed, while the grains of coffee remain hard and gritty in the same circumstances. Ground chicory is highly hygroscopic. Roasted grain, such as wheat and barley, gives an infusion with hot water, which is mucilaginous and thick, while the infusion of coffee is remarkably thin and limpid. The grain infusion generally contains starch, and gives, when cool, a blue colouration with iodine, while the infusions of both coffee and chicory appear to be entirely destitute of starch.

2. The more deep and rapid colouration of water by chicory and the allied roots than by coffee, affords a useful indication in a preliminary examination. The roasted grains also appear to colour water more deeply than coffee does.

The relative colouring power of coffee, chicory, and other vegetable substances was investigated, and the results are given in tables. From thence it appears that 2·22 parts of chicory have the same colouring power as 5·77 grains of highly-roasted, and 6·95 grains of medium-roasted coffee, or of 13·33 grains of roasted peas, and 40 parts of brown malt. When a few grains of roasted chicory, or any other sweet root, are dropped into a glass of cold water, without being stirred, a yellowish-brown colour diffuses rapidly through the liquid, while the pure coffee gives no sensible colour to the water in similar circumstances.

3. Another property of infusions, which is still more precise and valuable, is their specific gravity; and a table is given showing the specific gravities of infusions made from a large variety of substances, from which it appears that the leguminous seeds give a low specific gravity,—peas 1007·3, and beans 1008·4. The coffees are also remarkably low, varying from Mocha coffee 1008·0, to Costa Rica 1009·5; while chicory rises greatly, ranging in different samples between 1019·1 and 1023·2. The cereals are equally high, or still higher, in the scale of gravity; rye-meal being 1021·6, and maize 1025·3. The low gravity of the coffee infusion, therefore, distinguishes it sharply from the two most important classes of adulterating substances,—the roots and cereals.

4. The action of other solvents is then referred to, but of these that of ether is the most easily ascertained, coffee yielding much more soluble matter to ether than beans, maize, or chicory.

5. Fermentation by means of yeast gives a decisive proof of the adulteration of coffee by many vegetable substances, particularly by chicory and other saccharine roots.

The substances were examined for sugar, both before and after being roasted, as it was interesting to observe the extent to which the sugar is caramelised, by torrefaction, in the different substances. The sugar of coffee is found to be reduced by roasting from 6 to 7 per cent. in raw coffee, to from 0· to 1·12 per cent. in the roasted, —or to be almost entirely destroyed; while in other substances the sugar is more generally reduced, by precisely similar treatment, to from one-half to one-third of its original proportion. The fermentation test is considered as well adapted to detect adulteration by chicory and the sweet roots, and likely, from its certainty and facility of application, to prove eminently useful for that purpose.

6. The ashes of coffee and the various vegetable substances used in its adulteration, afford valuable characteristics of the plant. Coffee is remarkably distinguished from roots and cereals, by the small quantity of silica it contains. Out of twelve samples analysed, there was only one case in which the silica approached to a half per cent. of the ash, whilst on the other hand, in four samples of chicory tried, the silica and sand amounted to so much as 10·69, 13·13, 30·71, and 35·85 per cent. It may therefore be assumed that the presence of one per cent. or more of silica in the ash is a proof of adulteration. The report then gives the complete analyses of the ashes of the twelve samples of coffee and four of chicory, from which it appears that the absence of soda in the coffee ash, and its presence, to the extent of from 2·04 to 15·1 per cent. in chicory ash, may be remarked. In chicory, the lime is greater and the magnesia less than in coffee. The sesquioxide of iron is strikingly different, being always under 1 per cent. in coffee, and ranging from 3·13 to 5·32 per cent. in chicory. The ash of chicory is, on this account, red to the eye when compared with that of coffee. The difference in chlorine is also important, the highest proportion observed in coffee-ash being 1·11 per cent., and the lowest proportion in chicory-ash 3·28 per cent. Coffee gives an ash which is highly carbonated, the carbonic acid varying from 14·92 to 18·13 per cent.; while the ash of chicory is only slightly carbonated, containing from 1·78 to 3·19 per cent. of carbonic acid. The proportion of phosphoric acid is pretty similar in the two kinds of ash. Tables showing the analysis of certain seeds and roots are given, which show that in the ash of the dandelion root only, the silica is sufficiently large in quantity to make a good distinction from coffee.

7. The report goes on to exhibit the action of certain chemical re-agents upon infusions of coffee and chicory as a means of detecting adulteration, but these appear not to be of much service for the purpose.

8. The quantity of nitrogen found in coffee is greater than that in chicory, but the difference is not sufficiently marked to distinguish the two substances easily from each other, though less than two per cent. of nitrogen affords a strong presumption of adulteration.

9. The report gives Professor Rochleder's and Mons. Payen's analysis of raw coffee, but it does not appear that any practical result, for the purpose of detecting adulteration, arises from them.

10. Experiments were made especially to determine the properties of caffeine in raw coffee; the results are given as follows:—

In Native Ceylon	0·80 per cent.
,, ,, ,,	0·80 ,, ,,
,, ,, ,,	1·01 ,, ,,
,, Plantation Ceylon	0·54 ,, ,,
,, ,, ,,	0·83 ,, ,,

The only other substances besides coffee in which caffeine is known to exist, are tea, Paraguay tea, and a species of chocolate made from the *Gaurana officinalis* or *Paullinia sorbilis*.

11. Chemists generally refer the flavour of coffee more to its acid—caffeic acid—particularly when modified by roasting, than to any other constituent. Caffeic acid, so far as is at present known, is confined to the coffee plant, and it possesses a property which facilitates the detection of that substance, and, therefore, of coffee in a mixture. Caffeic acid is analogous to kinic acid, the acid of the cinchona barks, yielding kinone when oxidated by means of sulphuric acid and binoxide of manganese. The tests for kinone can be applied in a few minutes, and they are sufficient to indicate the presence of 10 or 12 per cent. of coffee in a mixture.

12. The root of chicory presents no feature of a marked nature, beyond its large proportion of sugar and the com-

position of its ash, which have both been sufficiently adverted to. The proportion of fat naturally in the root is quite insignificant. Chicory, however, as well as the other several roots, such as turnips, beet, &c., present little that is tangible in their chemical properties. The high colour of the infusions of all these roots when roasted, the great density of their solutions, and their fermentability, afford sufficient means for distinguishing them from coffee, and for discovering their admixture with that substance.

ON TEACHING PHYSIOLOGY AND ITS APPLICATIONS IN COMMON SCHOOLS.

The following is the substance of a paper prepared by Mr. George Combe, of Edinburgh, to be read before the National Association for the Promotion of Social Science. The author says:—

"In one respect, physiology may be said to be a science only in its infancy, and in another, to be already so far advanced as to be capable of valuable practical applications. This apparent paradox admits of an easy solution.

"The most learned physiologists are still in a state of profound ignorance concerning the intimate processes carried on in the tissues of the human body, which produce the phenomena of life. This knowledge, nevertheless, is indispensable to raise medicine to the dignity of an exact science; and as it has not yet been attained, some persons represent the healing art as one of a purely empirical character; and physiology, on which it professes to be founded, as at present a chaos of conjectures.

"But, on the other hand, it is undeniable that much is known concerning the structure, functions, and conditions of health of the vital organs, as well as concerning many of the causes of their abnormal action; and on this knowledge medical practitioners found a treatment of disease that is at once rational and beneficial. But the same knowledge is available for the preservation of health, and for the advancement of social well-being in other departments of life, and on this account it may be made an important branch of instruction in common schools.

"A few elucidations will suffice to show the manner in which it has been successfully taught in some seminaries, to children and young persons, of ten years of age and upwards, and also the applications to practical conduct of which it is susceptible."

To prevent misapprehension, the author begs to state that he does "not recommend physiology to be taught in common schools in the form of lectures, but in that of lessons, in which the children themselves shall take a part, and in which there shall be a constant interchange of remarks, question, answer, and inference, between the pupils and their instructor. Moreover, in these lessons no attempt should be made to teach the science or practice of medicine."

"In an ordinary medical education instruction is given in the following branches.

"1st. Anatomy, or the structure of the human body.—The teaching under this head embraces descriptions of every bone, muscle, nerve, and viscus in the body, with their attachments and connections, so minute that the student may know how to discover their position; and how to recognise abnormal changes in them in living subjects, with a view to medical treatment, or, if necessary, to operate on them.

The author does "not recommend teaching at all approaching to this in detail, nor with a view to these objects."

2dly. Physiology, or a scientific description of the functions of every cell, tissue, bone, nerve, muscle, and viscus in the system, according to the profoundest views of the most recent investigators.

The author does "not recommend teaching physiology in this manner."

3dly. Pathology, or the diseased structure of every cell, tissue, bone, and viscus of the body.

The author does "not recommend this instruction to be given."

4thly. The practice of physic, or the application of all the foregoing branches of knowledge to the diagnosis and cure of disease.

"This is not recommended to be introduced."

"This statement of negatives is made because medical men in general, to whom the directors of schools naturally look for advice, have these modes of instruction in their minds (few of them having seen any other in operation), when they deliver opinions on the propriety of introducing physiology into schools.

"The kind of instruction recommended, and which has already been successfully taught in some seminaries, may now be mentioned. The plan of it is this:—A description of the various organs of the human body on which health and life depend, is given in simple and popular language, but scientifically correct, so as to avoid sowing error in the mind of the pupils; the use or function of the part is described in the same manner, the exposition being plain and popular in language, but in principle sound and scientific, challenging the criticism of the highest medical investigators. The influence of the different organs on each other is then explained; and the knowledge thus communicated of the structure, functions, and relations is applied to elucidate the natural conditions on which the healthy and unhealthy action of each vital organ depends; in other words, the causes of good or bad health, and the means that should be used in our daily habits to secure the one and avoid the other. The practical application of this knowledge lies, in a greater or less degree, within the power of every intelligent person, and much disease and suffering in ordinary life may be avoided, and much substantial enjoyment gained by acting on it.

"The instruction concerning the use of each organ is founded on its structure and its relations to the other organs; and the structure is described in other words, and as far as possible illustrated by preparations and by diagrams. It is generally acknowledged, that not children only, but adults also, more easily and distinctly comprehend, and longer remember, an object after having seen it, and heard it at the same time clearly described, than by merely reading about it. Now, the object in introducing the human skeleton and diagrams of the muscles, lungs, heart, and blood-vessels, and other vital organs, into schools, and giving *viva voce* descriptions of them, is to do effectually what a book is capable of accomplishing only imperfectly, namely, to convey to the pupils correct ideas of the structure, so extensive as to serve as a solid basis for understanding the uses or functions of the parts, and the influence of the vital organs on each other, and on the whole corporeal system; in other words, to understand the natural conditions on which health depends, and the causes which produce disease.

"The use or function is far better understood when founded on a demonstration of the structure than when communicated merely by verbal description as a general and unsupported fact. Actual knowledge of the structure and functions renders the relations of the vital organs to each other intelligible, and their reciprocal influence highly interesting;—for example, it enables us to comprehend the influence of the digestive organs on the power and activity of the muscles, lungs, and brain; the influence of the brain over the heart, the lungs, and the stomach; the influence of the circulating fluids in forming, supporting, and repairing the waste of all the organs; and so forth. And, as already remarked, this knowledge of the structure, functions, and relations of the vital organs all combined, lays the foundation for a clear exposition of the laws of health, by teaching which, we point out the course of action which every individual should habitually observe in order to promote his usefulness and prolong his enjoyment of life.

"The sexual organs and functions are omitted in the lessons and diagrams, and it is not found that this

omission materially affects the practical value of the instruction given; for these being organs of reproduction, their functions do not directly involve the life of the individual, as those of the vital organs, such as the heart, lungs, stomach, brain, and intestines do. Moreover, the same laws of health which govern the vital organs hold good in the case of the organs of reproduction, and in so far the instruction given is indirectly applicable to them.

"As already observed, the instruction given is sound and scientific in its basis and character, although limited in extent and popular in expression.

"This is the kind of instruction which has been introduced with advantage into several schools, and a few reasons may be offered why it should be generally adopted.

"The deaths that occur throughout England and Wales, and also the causes of them, and the ages of those who die, are reported to the Registrar-General, and by him classified and reduced into tables, which, accompanied by his commentaries, are annually presented to Parliament and published. Soon after this regulation was introduced it was discovered that there were great differences in the rates of mortality in different districts. The excess of death in some localities, amounting to 10, 20, 30, and even 40 per cent. over the number of deaths in other situations, among the same number of people, of the same ages, attracted attention; the causes of the excess were investigated, and found in many instances to be avoidable or removable by application of the natural means of health.

"A Sanitary Commission was appointed by Parliament to apply these means, which consist of draining, removing nuisances, ventilating houses, supplying warmth, inducing habits of cleanliness and temperance, and so forth, among the people. This Commission made extensive investigations, and published valuable reports, which were printed by Parliament for general instruction. The burden of these reports year after year was, that their best efforts were obstructed, and often rendered nugatory, by the prevalent ignorance among all classes, of the natural conditions of health, in consequence of which the advantages of the sanitary measures recommended were neither understood nor appreciated; and even where there was a desire among the people to carry them into effect, their ignorance acted as a formidable obstacle to their doing so.

"The government were informed that the best method of removing this obstruction was, if possible, to instruct the people generally in the natural conditions of health and disease, by teaching them so much of the structure of their own bodies as might enable them to understand the functions of the vital organs, and the influence of damp, dirt, foul air, miasma, intemperance, and other causes which obviously produced the excess of disease and death. Moreover, the government were convinced of the great importance of introducing physiology into juvenile schools, and had even taken steps to do so; when, with a view to strengthen their hands, and those of every one interested in improving the sanitary state of the people, the document drawn up, and subscribed by sixty-five of the leading physicians and surgeons of London, including the principal teachers of anatomy and physiology, and the practice of medicine and surgery, in the metropolis, and also all the medical officers of the royal household." *

The author then adverts to the law passed by the legislature of Massachusetts.*

He then proceeds thus:—"Instruction in Physiology and the laws of health is highly beneficial to the children, in reference not only to their future social character, but also to their welfare as individuals. It tends to give them intelligent notions of the means by which disease may be avoided, and health promoted in their own persons; and thereby renders doubly efficacious rules given to them by their teachers regarding their personal habits of cleanliness, temperance, and exercise; the avoidance of foul air, damp clothes, ill-aired rooms, and so forth. It comes home to their minds as having a solid basis in nature, instead of resting solely on the authority of the teacher. After they understand the natural, and, therefore, inevitable, consequences of neglecting or infringing the conditions of health, the pupils will become aware that such conduct may bring suffering and premature death upon them, although they may elude the vigilance of their masters, or defy the admonitions of their friends. Moreover, it will enlighten them in the management of their own offspring, should they live to become parents, and will add to their intelligence and usefulness in following medical advice in cases of domestic sickness or of general visitations of epidemic disease.

"These lessons are beneficial also as a means of training the mental faculties of the pupils. They teach them to observe accurately things that exist—to study their modes of action—to comprehend their relations and effects, and to draw from them practical conclusions directly involving their own well-being. All the information recommended to be given will be real; and as it will have direct application to the pupils themselves, it will naturally interest them, as well as instruct and discipline their understanding."

The author concludes by pointing out the application of Physiology to the elucidation of social economy, and gives a report of a lesson which he gave with great success to a class of children of the working classes in the village of Charlton, Dorsetshire.

* See *Journal*, vol. v., page 678.

UNITED ASSOCIATION OF SCHOOLMASTERS.

The Fourth Annual Meeting of this Association was held, by permission of the Council, in the Society's Great Room, on Monday and Tuesday last.

On Monday, at two o'clock, the President, Mr. Thos. Tate, F R.A.S., delivered his annual address, in which he reviewed the chief educational events of the past year. The Secretary, Mr. J. Tilleard, read the annual report of the Acting Committee It appeared that the total number of ordinary members was 238. The title of Honorary Member had been conferred on the following distinguished educationists, and accepted by them:—Dr. Booth; the Dean of Hereford; Rev. G. R. Gleig; J. Martin, Esq.; J. D. Morell, Esq.; Canon Moseley; J. S. Reynolds, Esq.; Canon Richson; D. Stow, Esq.; E. C. Tufnell, Esq. Eight general meetings had been held during the year in St. Martin's Hall, when papers on subjects connected with teaching had been read, followed by discussions. The report goes on to say:—

"In the beginning of the year a communication was received from the Department of Science and Art, inviting the co-operation of the Association in the organisation of the Educational Museum. Having ascertained that the Department of Science and Art desired that the Association should co-operate with it by suggesting from time to time additions to the objects collected, or improvements in their arrangements, your Committee recently submitted to the Department various suggestions, by the adoption of which, we believe, the Museum would be rendered more instructive to teachers.

"We do not doubt that the members will agree with us when we say that Her Majesty's Government has conferred a great boon upon teachers by establishing this museum; and we feel certain that this association will at all times be glad to afford a hearty co-operation to the Government, in perfecting a work of such importance to national education.

"We are of opinion that the establishment of the museum has superseded the necessity for the permanent Educational Exhibition contemplated by this association; but we consider that it is desirable to have a library of educational works for the use of the members, and that, with this view, means ought to be taken for extending

the collection at present deposited at the St. Thomas Charterhouse Schools, by the kind permission of the Rev. William Rogers.

"It is with much gratification we report that in May last the sum of £100 was most liberally placed at the disposal of the Association by a distinguished promoter of education, to be applied in giving a prize of £25 for an Essay on "The best means of making the Schoolmaster's function more efficient than it has hitherto been in preventing misery and crime," and in promoting the publicity of the Essay,—the remainder being carried to the general funds of the Institution. Your committee accordingly took steps to make the offer extensively known, and as many as thirty Essays were sent in by the appointed date, the 1st of November. The writer was required to direct his attention particularly to the following points:—1. The subjects to be taught. 2. The method of conducting the teaching and training. It was also stipulated that the copyright of the successful Essay should become the property of the Association. The adjudicators were the Rev. Dr. Booth, your corresponding secretary, and Mr. Shields, who were nominated respectively by the Council of the Society of Arts, your committee, and the donor. The prize has been awarded to Mr. E. C. Tainsh."

It appeared that, owing to this munificent donation, the Association had been entirely released from debt, and, after paying all the expenses connected with the Prize Essay, would probably have a small balance in hand.

At 3.30 p.m., Mr. H. Seymour Tremenhere, Inspector of Mining Districts, gave an address on "Associations for offering Prizes to be competed for by groups of Schools, commonly called Prize Schemes; and on a proposed Public Examination of all boys leaving the Day-School finally, who may choose to present themselves for examination." Mr. Tremenhere, after explaining his proposed scheme of examination, requested the Association to give it their consideration, and to report to him their opinion upon it. The matter was accordingly referred to the Acting Committee.

At 6 p.m., the Rev. W. Taylor Jones, M.A., Vice-President of the College of Preceptors, delivered an address, "On the Prospects of General and Comprehensive Union among all ranks of the Scholastic Profession." An animated discussion followed.

At 7.30 p.m., Mr. John Ogle delivered a lecture on "Thoroughness in Education." A discussion followed.

On Tuesday, at 2.30 p.m., Mr. R. Bithell gave a lecture on "The Objects sought by Association among Schoolmasters"

At 3.30, Mr. T. Crampton gave a lecture on "Political Economy as a Branch of Education."

At 7, the chair was taken by Mr. Henry Cole, C.B., one of the Secretaries of the Committee of Council on Education.

A very full meeting of teachers and promoters of education assembled to hear the above-mentioned Prize Essay read by the writer. The Chairman, after briefly mentioning the circumstances connected with the offer of the prize, handed to Mr. Tainsh a cheque for £25, the amount of the prize, and called upon him to read his Essay. In the course of the reading, Mr. Tainsh was very much applauded. A discussion ensued, in which the following gentlemen took part:—Mr. Tate, Dr. Hodgson, of Manchester, Mr. Williams, of the Midland Institute, Mr. Shields, Mr. Coghlan, Mr. Drew, and Mr. Tilleard.

On the motion of Mr. William Ellis, a vote of thanks was given to Mr. Cole for his excellent conduct in the chair. The meeting separated at 10 o'clock. Among others present at it, were the Rev. William Rogers, the Rev. Dr. Poggi, Principal of New Brighton College, Mr. McLeod, of the Royal Military Asylum, Chelsea, Mr. Langler, of the Wesleyan Normal College, &c. The Prize Essay, together with a report of the discussion thereon, will be published for circulation among the members, and for sale.

SOUTH KENSINGTON MUSEUM.

His Imperial Highness Prince Napoleon has transmitted to the Committee of Council on Education a very interesting specimen of Gobelin tapestry, the subject being, "Arria presenting the dagger to her husband, Pœtus, after having stabbed herself." This piece of work was commenced under Louis XVI., was completed during the period of the Republic, and received its border in the early days of the first empire. It was given on his marriage, in 1807, to Jerome, King of Westphalia, by the Emperor, his brother. Prince Jerome has just given it to his son, Prince Napoleon, in order that it might be presented to the Museum of Art at South Kensington, as some proof of the interest which they both took in that establishment. Viewed for its money worth, this specimen must have been valued at above £2,000, but looking to the curious facts of its history it is of far higher value, as an evidence of the friendly relations which have sprung up between the two countries, not merely in politics, but in the promotion of the arts.

During the week ending 26th December, 1857, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 6,156; on Monday, Tuesday, and Saturday (free evenings), 3,244. On the three students' days (admission to the public 6d.), 378. One students' evening, Wednesday, 70. Total, 9,848.

NEW PROCESS OF MAKING BREAD.

Some months ago a new process of bread-making was patented by Dr. Dauglish, of Carlisle. The theory has been reduced to practice; and a machine on the new principle is now in operation. According to the ordinary process, fermentation is produced by the action of the yeast upon the particles of starch in the flour, thus liberating minute bubbles of carbonic acid gas, which permeate the entire mass of the dough, and make it "rise." The chemical change, however, which here takes place is such that it has been estimated by M. Dumas that in France 17½ per cent. and in England 8½ to 12 per cent. is wasted by the decomposition which takes place in the process of fermentation. In the new process patented by Dr. Dauglish no yeast or baking powder is used, the rising of the dough being effected by water impregnated with carbonic acid gas. The idea of making bread with aërated water is not a new one; a patent was taken out for such a process some years ago, but it was then found that when the flour was mixed with the impregnated water, the gas escaped before the bread had time to rise. The novelty of Dr. Dauglish's patent consists in preventing the escape of the gas from the water by subjecting the materials to an outward pressure of carbonic acid gas while the flour is being mixed with carbonated water. The carbonic acid gas is generated in such apparatus as is usually employed by soda-water manufacturers; the gas is pumped into a large reservoir, from which it is forced, as it is required, into a vessel containing water—the absorbing power of water for carbonic acid being very great. The kneading machine is a strong iron retort, fitted with air-tight lids, and provided with revolving prongs in the inside for mixing the dough. In the machine now in operation, this retort is capable of containing 40 stones of flour. Into this are put 20 stones of flour with the requisite amount of salt. A stream of carbonic acid gas is forced into the retort, and a sufficient quantity of carbonated water is admitted, and well mixed with the flour and salt; the gas with which the water is impregnated being prevented from escaping by the pressure of the carbonic acid gas. As soon as the flour and water are mixed, a pipe is opened and the loose gas is let out. The consequence of the pressure being taken away from the surface of the paste is, that the gas which was held in solution by the water operates in precisely the same manner

as the gas in a bottle of soda-water when the cork is removed, the dough rises and fills the retort, occupying twice as much space as before. The bread is then ready to be worked into loaves—the only operation that will necessitate handling. The rising can be regulated by the pressure of gas; so that, did the strength of the machinery permit, the bread might be made almost any lightness. The pressure of the gas, and the quantity of water admitted, are regulated by gauges.

Home Correspondence.

THE EXAMINATION QUESTION.

Sir,—The Society of Arts, Manufactures, and Commerce, was originally established for the promotion of progress therein, working chiefly by the examination of practical results laid before them, for which they awarded prizes. They were not an educational body, other than as stimulating the acquisition of improvement, by premium and supposed reputation therefrom.

They now extend the sphere of their Examination from practical art to elementary and abstract science, exact and inexact, and also to languages; they still do not profess to teach, save incidentally, but only to Examine.

But there is this difference. In every thing connected with practical art, the Society confines its operations within the limits of its own house in the Adelphi, and the Examiners are unpaid. In abstract science, the Society is to operate both at home and at various centres in the provinces, and the Examiners are to be paid.

I think this distinction ought not to exist. There is as much reason why the Examiners should be paid in one case as in the other. Physical production is the proximate source of national wealth and power, and excellence should be as prominently put forward from the Adelphi, as it was from the Great Exhibition in Hyde-park. It is quite right that the abstract knowledge which can produce or improve arts, should be quickened as well by the Society as by Colleges and Universities, but it is not right that the Society should resign its one peculiar avocation of the practical, in favour of the abstract. The value of many of the sciences consists in their facilitating the processes by which humanity procures meat, clothes, fire, dwelling, health, amusements, enjoyments, education, and freedom from the general uncertain condition of the beasts that perish. The science of mechanics would be a child's toy, did it not fructify in ships, machines, buildings, steam-engines, railways, and other similar things. The science of chemistry would be a business of mere conjuring, did it not take a practical form in cheapening the conversion of matter to the uses of humanity. Of course this is without reference to the especial enjoyment of the philosopher in these pursuits from the love of knowledge and investigation. But the object of the Society, its special purpose, is the transmutation of abstract science into practical art, a matter wholly neglected by Colleges and Universities. If Colleges and Universities only teach science, it is the business of the Society to link it on to art, and if the teaching be insufficient, it is the Society's business to point this out by Examinations. The Royal Society deals with the constant growth of science, recording new facts as they arise,—a step beyond the Universities. The Society of Arts takes the next step in recording the union of the new facts with the arts, extending them to manufacturers, and distributing them by commerce.

The general members of the body have, therefore, a right to demand that the Examinations in the abstract, shall only take place out of the surplus funds that may exist after the due satisfaction of the practical.

And there is as much reason for extending the centres of examination in the one case as in the other. It is a question of the number of those to be examined. If they be many, it is obviously better to send the examiners round, provided always that the means be forthcoming. If the examined be few, there seems no reason why they should not attend in London, at the cost of their respective Institutions. It is apparently considered, by Mr. Baines and others, to be of importance to obtain the special *fiat* of the Society's Examiners, in preference to a local Examination, and, if so, the expense should be borne rateably, and not wholly saddled on the subscribers to the London Society. There seems to be no reason why the competitors in the provinces should not settle on the proficiency of their best members, and send them up to London for confirmation.

But there is the question of the *cui bono* to consider. Study for its own sake is its own reward. *Ergo*, the people desiring public examination do not study for the sake of study, but for some other reward, either the reputation for the sake of reputation, or the reputation for the sake of employment and promotion. If the Society gives certificates, those certificates are supposed to obtain a preference with employers. This supposes that the employers are not competent to examine for themselves. If this be so, then the practical results of the system carried to its full extent would be to fill up all employments with stereotyped officials. Now, this would tend to perpetuate a dead level,—to create a nation of Chinese. It is very certain that the routine which grows by officiality, has a constant tendency to perpetuate itself, and to be a drag on progress. In all departments, the large proportion of eminent men are outsiders, irregulars, men who have casually hit upon their natural aptitude in these vocations, and such men constitute our national superiority. For example, it was not Examinations that produced a Faraday, but absolute love of study and progress. Public bodies for the most part only represent average men; the *élite* of progress are ever beyond them, and the greatest of all faculties, energy, *i.e.*, the greatest faculty in natural progress, no examinations can determine on. Unnatural energy is sometimes developed for a University Examination on abstractions, which leaves the competitor not uncommonly a wreck for life.

The country of maximum Examination is, probably, China; the country of minimum Examination and haphazard is England. How far an extended system of Examination in England will stimulate, and how far it will induce very respectable mediocrity is well worth an experiment, and it would be well for the Society, while keeping a record of those who take prizes, to keep also a record of their after-progress in the actual business of life. Self-taught men rarely seek for examination; they *use* their knowledge rather than display it, and it may be worth while to consider how far Examination is valuable other than as patronage. If it be patronage, there is a the chance of its degenerating into mere favouritism and routine. How many Examiners can be found, earnest as well as intellectual men, if the system of Examination is to become universal, to ensure that only the worthy obtain the prizes? I can understand a select body working well, but not the mass. Every human being is an individual, and to test all individuals by the same sets of questions would be a fallacy. The examiner then should be a moral as well as intellectual philosopher, or he will only be a kind of grinder's tool, a hard materialist, and, inasmuch as the world, after all, is ruled by instincts and sympathies more than by mere brains, it is quite impossible that the system of examinations should develop more then mechanical servants, except under the care of certain select guides and first-class philosophers. The possession of godlike attributes in a teacher, induces disciples of similar faculties to gather round him, but he cannot create them. Numerous students will study hard to pass an examination, some in one branch, some in more, but it is by no means certain that the enthusiasm with the hard work will be of that kind which goes through life; the soldier who will be prominent in the breach is not commonly the one who will best discharge garrison duty.

It cannot be doubted that oral examinations, in conjunction with written ones, will be best adapted to bring forth existing faculties, but it may be doubted if oral examinations, without written ones, should be held sufficient. If a man possesses faculties, and no utterance, he is not an efficient worker; and faculty of utterance, either by writing or speech, if not by both, should be held as part of the qualification for passing. But the oral examination should be held rather as a test of the truth of the writing—that it is the writer's own production, and not mere cram—than as any proof of positive skill.

I, for one amongst many members, say, let the examinations go on in abstract knowledge as well as in indirect material results—to the full extent of the Society's funds and power, and let the examiners be paid; but let the house of the Society be the sole seat of examinations, over which both Council and members may watch. There does not seem to be much difficulty in the matter. Let the candidates prepare their papers, which can be attested and sent up to the examiners. From these, those worthy of prizes can be selected, and the writers can then be sent up at the expense of their respective Institutions for oral verification. This would meet all the circumstances of the case;—would give more than the *éclât* of peripatetic examination—if *éclât* be desirable—and would not saddle the parent body with those expenses fairly belonging to the Institutes, and at the same time would prevent the valuable time of the examiners—professors settled in London—from being wasted.

It is a great experiment, worth being fully tried, but not at the cost of swamping all the objects for which the Society was originally formed. But I believe that one result will be much cram; and I hold it far more important to put before the great mass of the community the means of studial acquisition—which the facultied individuals may absorb—for they cannot be *taught*. They can only learn, thus, to exhibit a large quantity of forced or hothouse acquirement on an examination platform. "By the hammer of Thor" we are a nation as noble as exists on this round world. How much better we may be made by examinations I know not, but the widely-spread system of continental examinations has, up to this time, failed in making any continental nation as great as ourselves in arts, manufactures, or commerce. We have, withal, preserved our freedom to do still more, and I feel convinced that if examinations are to be made really useful, it must be by some system in which patronage is not a main element. The putting half-a-dozen state appointments at the disposal of the Society by influential members, has no soundness in it. I will return to this subject at a future time.

I am, &c.,

W. BRIDGES ADAMS.

1, Adam-street, Adelphi, December 25, 1857.

THE BYE-LAWS OF THE SOCIETY OF ARTS.

SIR,—At the recent Special General Meeting of the Society of Arts, great stress was laid by the Council on the illegality of the Bye-laws relating to the Board of Examiners, which the members were then called upon to revoke, but the question how and when the said illegal Bye-laws came to be adopted, was left unanswered. It is desirable, therefore, that the members should be put in possession of facts which show in how loose and careless a manner some, at least, of the business of the Society has, hitherto, been transacted, and prove that the Bye-laws generally require revision.

As to the mode in which the Bye-laws in question, and several others, were framed by the Council, I, together with every other member of the Society not on the Council, must remain ignorant, but that they were adopted at a Special General Meeting (?) of the Society, held on Thursday, the 19th February, 1857, the *Journal* of the Society (No. 223), without referring to the minutes, is sufficient evidence. This Special General Meeting, I presume, was legally convened by the proper authorities, but how came it that no notice was given in the Society's *Journal* that such a meeting was to be holden? It is true that one advertisement was inserted, on the previous Friday, in the advertising pages that form the wrapper of the *Journal*, but as these pages form no part of the *Journal* itself, the spirit, if not the letter, of the Bye-laws was in this particular evaded. But now comes the important question. Of how many members was this Special General Meeting composed. Five members only, besides the Chairman and Dr. Booth, were present, but when the Bye-laws relating to the Board of Examiners, and others of equal import, were adopted, even those five members were not all present. Would this number in any other Society have constituted a legal meeting? The Bye-laws of the Society of Arts, however, admit any number of its members, few as it may be, to constitute a General Meeting, since (will it be credited?) they omit to fix the number that shall form a *quorum*. The Society of Arts, I believe, numbers above two thousand members; the Council, including the president and vice-presidents, numbers thirty-four. The Bye-laws enact that "at all meetings of the Council three shall be a quorum, except when otherwise directed by the Bye-laws," but, for a General Meeting of the Society, it appears that even two members, in addition to the chairman, are deemed sufficient to form a quorum.

The Bye-laws relating to the Board of Examiners were not the only Bye-laws adopted at the meeting in February last. Chapter XV., containing nine clauses relative to the "*Union of Colonial, Scientific, and Literary Institutions*," and Chapter XVI., containing four clauses relating to "*Honorary Local Secretaries*," were then made and adopted. Other minor alterations in the Bye-laws were also made, and some of greater importance proposed by the chairman—the latter, however, were negatived by the meeting. The few members present were apparently opposed to the views of the Chairman, and how those Bye-laws, which the members were lately called upon to revoke, were then adopted, I cannot imagine. Are we, to quote the words of Mr. Cole the other evening, to suppose there was some *hocus-pocus work*? But mark the confusion into which the whole of the Bye-laws have been thrown by the transactions of this "hole and corner" meeting. By what authority have the numbers of the various chapters and sections of the Bye-laws been altered? Let any member refer to the printed copy of the Bye-laws, bearing date Oct. 19, 1855 (reprinted November, 1856), and that of Feb. 19, 1857; would it be incorrect to assert that all the Bye-laws comprehended in the seven chapters following Chapter XI. have thus, by the unauthorised alteration of the numbers of the various chapters and sections, been rendered illegal? These seven chapters embrace forty-five out of one hundred and six sections which compose the Bye-laws of the Society of Arts.

One fundamental error appears to have been committed in the original framing of the Bye-laws of the Society of Arts. Instead of a division of the several headings and chapters, and a subdivision of these chapters and sections, so that any particular clause could readily be referred to as chapter —th, section —th, the numbering of the various sections has been carried on from first to last without subdivision. What has been the consequence? Whenever it has been found expedient to revoke or amend any of the Bye-laws, or to adopt new ones, the introduction or omission of any clause has thrown all the others into confusion, and necessitated the alteration of the number of every successive section or clause. The number of the chapter or section of any Bye-law cannot legally be altered without the consent of a general meeting, since it forms an essential part and parcel of the Bye-law itself—in fact, the index.

The present Council have wisely taken the only steps in their power to obviate the dilemma in which they

have become involved by the proceedings of the so-called "Special General Meeting" of February last; but much remains to be done. The expediency of having a larger number of working members on the Council must be considered. Nothing can more forcibly exhibit the disadvantage of intrusting the affairs of so large a Society in the hands of a few than the facts above mentioned,—when it is in the power of the Chairman of the Council, aided by two or three members, to make any alterations they may please in the Bye-laws of the Society.

I am, &c.,

J. B. S.

December 5th, 1857.

DRAIN PIPE MACHINERY.

Sir,—This machinery, now in such general use, is identical in all its details, with the exception of magnitude, with that which has been in use for some centuries in all the macaroni districts of Italy, that is to say, from Genoa to Naples inclusive.

It is, moreover, a fact, that about the year 1820, Italian machinery for the manufacture of macaroni, was set up and in use in Cromer-street, London, by C. W. Fletcher, the late Lord Byron's valet, in conjunction with two Italians. Priority of claim, therefore, for this ivention can scarcely be claimed by any Englishman of the present day.

The double edgestones used for crushing raw and burnt clay, have always been used by the Italians for grinding or crushing various materials, as well as for kneading the macaroni dough, but they have a different mode of setting them to work from what is usual in this couutry. They always mount them so as to lean outwards at a considerable angle, a position which, combined with the necessary conical bevilled edge, gives them double the grinding power that is obtained by the vertical-edge stones, with cylindrical edges, which would only roll on in a straight line if left to themselves, while these would revolve in a circle of contrary curvature.—I am, &c.,

HENRY W. REVELEY.

COAL AND COKE.

Sir,—I was much gratified with the review of my letter on this subject by Mr. C. W. Williams, and only regret that I incautiously included that gentleman in the general category of patentees of smoke-preventing inventions, believing, as I did at the time, that Mr. Williams held a patent of some kind for that purpose. I also regret that Mr. Williams has had occasion to complain of my observations on the Prize Essay as regards the subject of ash-pits, which is passed over in the Essay with a very few words, and, on looking over Mr. Williams's diagrams, it is evident that the ash-pits are all, without exception, on the old plan, without any improvement whatever being suggested or indicated, not even the simple but very effective plan of causing the fresh air to rush in from the farther end of the boiler, closing the front opening of the ash-pit with an air-tight door, and reversing the slope of the fire bars. Certainly, no allusion to the possible defects of existing ash-pits, or improvements thereon, was made by any of the speakers at the reading of Mr. Apsley Pellatt's paper on the "Comparative Heating Powers of Coal and Coke."

I freely admit that my observations will scarcely apply to marine engines, which, in regard to confined boiler-room and miserable ash-pits, are in a very bad case. But I should hope that talent and genius may some day devise a less clumsy mode of propulsion than steam and coals, which together occupy more than half the vessel, and are very far from being pleasant companions at sea. It has been found that some steamers were inveterate smokers, only in consequence of the want of free access of air to the ash-pits. I do not uphold the preposterous long Cornish boiler for general use, but contend that in the common run of land engines there is not sufficient heating surface exposed to the fire to carry on evaporation with the greatest economy; and that the table of combustion and evaporation, inserted in Mr. Williams's letter, goes far to corroborate my assertion that where space is no object, as in land engines, slow combustion is more economical than quick, inasmuch as by the test applied, it appears that under a system of slow combustion one pound of coal evaporates 9·56, while, with hard firing, one pound of coal will only evaporate 9·48. I daily witness the awful destruction of furnace and fire-bars in all the land engines round this locality, with the exception of one—a 16-horse power, with a 25-horse boiler, which, though badly set up, works easily with sawdust, mixed with a small proportion of coal dust or waste cinders.

I cannot conclude without sincerely thanking Mr. C. W. Williams for the very kind manner in which that gentleman has noticed my crude observations, and with the hope that all discussion tends to progress,

I remain, &c.,

HENRY W. REVELEY,

Surveyor of Steam-boat Machinery under the Board of Trade.

Poole, Dec. 28th.

MR. UNDERWOOD'S PAPER ON INK.

Sir,—As Mr. Underwood, in his paper on the "History and Chemistry of Writing Ink, &c.," read before the Society on the 16th December, did not mention that we are indebted to M. Runge for the invention of a writing ink made with chromate of potash and decoction of logwood, which combination appears to be the novelty in the ink introduced to the notice of the meeting, I trust that in supplying the omission, I shall not be trespassing on the pages of your *Journal;* and I send you for insertion M. Runge's receipt, copied from the *Chemical Gazette* for 1849, page 108.

"A most excellent ink for steel pens is obtained by exhausting ten parts of logwood with a sufficient quantity of boiling water to obtain 80 parts of liquid. To one thousand parts of this decoction is now gradually added one part of yellow chromate of potash, when the liquid turns first reddish-brown and finally blueish-black. No gum or any other addition is requisite; on the contrary, they are injurious. This liquid is an actual solution, which may be filtered. No deposit is formed in it, and the writing is not removed by immersing the paper in water. Digler's Polyt. Journal, c. ix, page 227."

I am, &c., B. WINSTONE.

Sir,—In the report of the discussion which took place after the reading of Mr. Underwood's paper, the reporter has misunderstood the purport of what I stated.

The observations I made applied to the ferro-prussian, and not to the indigo blue, as he represents. It is very unfortunate that these two colours, so different in their chemical constituents, should always get confounded in the public mind, as is evidenced by the observations of Mr. Pearsall, reported in your *Journal*, who says that, having found that blue ink was obliterated from the accidental spilling of water over a sheet written upon with it, it had determined him against using it in future. It is in this way that prejudices are created and perpetuated, for if Mr. Pearsall had ascertained what sort of blue ink he had been using, he would have found that it was indigo, and not prussian blue, as he imagined. The one indigo, in the form long used for ruling and private marking, being a very soluble composition, and the other prussian blue, being one of the most fixed and durable colours, the writing from which bears soaking in water, in chlorine, and acids for a number of years, without parting with any of its colouring matters.

Having tested the durability of the solution of prussian

blue, by using it on wood tickets for distinguishing the variations of plants and flowers in gardens, as well as soaking it in solutions of chlorine and acids, I feel desirous to prevent, as far as I can, the perpetuation of prejudices which have no foundation beyond the mistake that is made by confounding the blue colour from indigo with that from prussian blue, and making the latter responsible for all the failings of the former colour.

I drew a sketch of the comparative permanence of the blue ink (prussian blue I mean) and that from the galls and iron, which your reporter has missed in his report. The following is the purport of what I said:—The inherent tendency of iron to pass from the state of a protoxide to that of per-oxide, is the main cause of the destruction of colour in the black ink. The iron in the ink, under the influence of moisture, absorbs oxygen, and gradually destroys the vegetable matter with which it is combined, leaving the writing a sort of iron mould upon the paper, in which state it is seen in old records and in writings that have been exposed to damp. The reverse of this takes place with blue ink made with the ferro-prussiate. The tendency of the iron to absorb oxygen increases the intensity and durability of the blue colour; thus the cause that leads to destruction in the one case, gives increased colour and permanence in the other.

I am, &c.,
HENRY STEPHENS.

54, Stamford-street, Blackfriars road,
Dec. 23, 1857.

AGRICULTURAL IMPLEMENTS.

SIR,—I have read Mr. Waller's letter in your *Journal*, and I am obliged for the information about Meikle's machine, with which I was, as he supposes, like most Englishmen, very imperfectly acquainted; and I shall be happy to accept his offer of a copy of his papers on Agricultural Implements. No doubt they will contain some useful information, and if they also show me how to include a history of mills, an account of all the schemes for ploughing by steam, and the disputed question as to the priority of the invention of the portable farm engine, as well as a list of all the agricultural implement makers from the last Salisbury catalogue, in a paper of an hour, without omitting the elementary information I did contrive to give, I am sure he will teach me what no one else can.

If he will read my paper over again more carefully, he will see that I did give Scotchmen the credit of inventing the threshing machine, the iron swing plough, the horse-hoe (Blaikie), and the reaping-machine (Bell). I still adhere to the statement that the Scotch, having been, for a long series of years, in advance of England in agricultural implements, have, for several years past, lagged behind. The first instance is the Scotch swing-plough, which was probably better than anything made in England twenty-five years ago, but which is now undoubtedly inferior to the iron wheeled-ploughs of our best makers. The superiority of English manure-distributing drills, horse-hoes, clod-crushers, and threshing machines, is attested by the sales effected by our principal makers in Scotland. My theory is, that while all implements of the farm were made on the farm, or in the village, the well-educated Scotch mill-wright or blacksmith had the advantage; but when the factory system was established, English implement makers went a-head. The seed-drill was used in Roxburghshire fifty years before it came into use in England. The Scotch (Finlayson's) drag harrow was much esteemed in England seventeen years ago, now it is superseded by the English, Coleman's, Biddell's, or some of the other factory-made cultivators. I throw out these observations not authoritatively, but rather with the view of eliciting information and discussion, but I should particularly like to know why the Scotch still adhere to the swing plough. In the last edition of Mr. Stephens's Book of the Farm, the only plough mentioned is the swing plough.

The question of prizes for agricultural implements is one which is worth discussing, and fit to be discussed in this journal, in a temperate philosophical style; and when I have leisure I shall be happy to give my mite of information, the result of an examination of the lists of all prizes that have been awarded by the Royal Agricultural Society since its formation, a document which will rather surprise the advocates of the prize system.

I am sorry Mr. Waller does not like hunting, as it does really afford an opportunity for seeing agricultural operations, and ascertaining the progress of thorough drainage, which cannot be obtained by a constitutional ride along the road. The barbarous state of cultivation in the metropolitan counties is a fact which cannot be denied, and which I should like to see explained.

Mr. Waller appears hurt at my unkind remarks on Essex, where, by-the-bye, they are very fond of swing ploughs, while the editor of the *Agricultural Gazette* thinks I ought to have taken more pains to contrast the districts where the best and worst implements are to be found, and I think the latter is right.—I am, &c.,

S. SIDNEY.

Central Farmers' Club, 24th Dec. 1857.

Proceedings of Institutions.

BOLTON.—On Wednesday, the 16th December, a lecture on "Stained Glass Windows," was given by Mr. G. J. French, president of the Mechanics' Institute. The lecturer glanced at the traditional account of the discovery of the formation of glass by certain Eastern merchants, after cooking their victuals on a sea shore. The two materials which, when fused together, formed glass, were fine sand and an alkali or alkaline earth, as potash, soda, or lime. If these were perfectly pure and free from other substances, the result would be a colourless glass, but impurities always mixed with the sand, as iron, copper, or lead, not visible to the eye, but being combined with the substance used, the metal had the effect of colouring the glass; impurities in the alkali had the same effect. The commonest glass, that used for bottles, was of a dull green colour, arising from the presence of iron rust in the sand and dirt in the ashes from which it was made. The white or colourless glass was a most valuable product, to which we were indebted for one of the greatest conveniences of civilisation. To make coloured glass it was requisite to mix in the melting pot some metal with the ingredients before mentioned. The coloured glass thus produced was called pot metal, or pot metal glass, which was blown in circular pieces or tables, similar to common window glass, and sometimes cast in plates. Mr. French exhibited specimens of this glass; the purple or ruby pot, red, yellow, blue, green, violet, and black—and named the ingredients from which they were produced. In different proportions the ingredients produced various tints of colour; they were also altered by the greater or less amount of heat to which they were exposed in the melting pot. A specimen of "ruby flashed" glass was shown, and the operation of forming it described. The lecturer then noticed the mysterious recipes which so recently as 50 years ago used to be published about the modes of making the coloured pot metal; it suited the makers at that time to cover their operations with a shroud of secresy. Most of the best discoveries in the art had been quite accidental; the ancient red glass was coloured by using gold in the pot, yet it was accidentally discovered, in a German glass-house, that a beautiful red might be procured from copper, and this was now done. Much stained glass had been imported into England during the last fifteen years, mostly from Munich, where it was largely manufactured. The colours were always very dark, with a great preponderance of blue. This glass was by no means pleasing, and occupied a very low station in art; but it had been rather largely

purchased, for no other reason than the depth and fullness of its colour. It must not be confounded with glass made at the Royal Factory of Munich, very little of which reached this country; it was of the very highest excellence in art, and differed in every respect from the manufactured glass described. The existing mode of blowing ruby glass was very old, perhaps as old as the introduction of any glass into this country, which is said to have been in the year 647; though there was little of it used in England for a long time after that period. Other colours could be treated in the same way as the ruby; such was the case with blue, but this was not done until the beginning of the 16th century, about the time that Henry the 8th came to the throne. The beautiful purple glass and its modes of production were next described. It was often said that the modern glass painters could not produce the rich ruby colour of the ancient masters; this was a mistake; there was no difficulty in its production at the present day—but the cost of the powder (a compound containing much gold) by which it was produced, caused the moderns to use less expensive materials, except for first-rate work. With reference to the term "stained glass," it must be remembered that the only *stain* that could be given to glass was a yellow one, that was the only colour which could be applied to glass as a stain upon its surface, for the colour in the pot metal and the flashed glass entered into actual combination with the melted materials. The production of the yellow stain was then described, and specimens shown. This yellow stain was unknown before the beginning of the 14th century, about the time of Edward I., and had ever since been much used in preference to the yellow pot metal. It possessed this great advantage, that while all other colours were diffused over the entire piece of pot metal glass, yellow could be applied partially. White glass might be ornamented with a yellow device; a yellow stain applied to each side of white glass produced a very rich colour; it might be applied to blue flashed glass, making it green, or to ruby, which it turned into a bright scarlet. Thus the yellow stain added greatly to the resources of the ancient glass painters. The lecturer then dwelt for a short time upon the materials which the glass painter does not or should not employ. The most imperishable materials should be used. Oil paint or varnish, even in small quantities, would prove at length a cheat and a delusion. He had more than once detected this fraud in expensive windows. Having described the materials for making a window, he asked their attention to a brief history of the art, the mode of executing the work, and the tools employed at various times. He would begin with what was called the Norman style of church architecture, commencing about the year 1066, and which continued until the year 1,200, a period of 134 years. The walls were remarkably thick and deeply splayed inside, and the windows very small and narrow, with rounded tops. The obvious intention of this arrangement was to admit as much light and to exclude as much bad weather as possible, and the inference to be drawn from this arrangement was that *no glass* whatever was used in such a window. The height also served to protect the people from wind and rain. Very little light could be supplied by these windows. The chancel, where the services were read, was usually better lighted with three windows of the same kind placed close together. Long before this time, however, glass windows had been occasionally used in churches, but no vestige of any glass of the Norman period had been discovered. With the early English style, which succeeded the Norman about 1200, and remained in fashion about 80 years, much more light was let into the church; the windows were longer and larger, often placed two, three, or five together, always with pointed tops, like a surgeon's lancet, hence called lancet-shaped windows. The early English was succeeded by what was called the *decorated* style of Gothic. The opening of the window was now much larger than before, and the head was often beautifully filled in with flowing and geometrical tracery. This style prevailed from 1280 to 1380 just one hundred years, when the first three Edwards reigned. The last style of Gothic architecture was called the perpendicular, because the principal mullions in the windows instead of diverging when they arrived at the spring of the arch, as in the decorated, ran straight up to the top, though delicate tracery was introduced between them. The perpendicular style lasted from 1380 to 1530, or from the time of King Richard II. to Henry VIII. inclusive. No glass of the earliest or Norman style had been found in this country. It was probable that ordinary churches had none. Of the early English style, many examples remained. During the early English period a great change took place in the style of glass painting; white glass of a beautifully translucent but not transparent kind, was largely employed; this was arranged in graceful patterns, the lead work flowing in finely-curved lines, a very slight proportion of coloured glass being introduced in small medallions and other graceful forms. The finest example of this kind of glass which he had ever met with was in the windows called the Five Sisters, in York Minster. The lecturer then exhibited some fine specimens of old glass of the period treated of. The specimens were proved to be above 500 years old by the absence of the yellow stain. He also exhibited some ancient specimens of French painted glass, proved to be before the time of our Edward III. The process of producing these was minutely pointed out. Mr. French then gave an elaborate description, aided by a coloured engraving, of the great east window of York Minster. John Thornton, of Coventry, contracted with the dean and chapter of York to glaze the window in the space of three years, drawing the figures and ornaments, and painting the glass himself. The materials and such assistants as he required were provided by the dean and chapter, who also agreed to pay him as wages every week 4s., at the end of each of the three years £5, and after the work was completed £10 more for his reward. The windows of St. Stephen's Chapel, Westminster, were executed under the charge of one John de Chester; that is, of an artist named John, a native of Chester. He had 7s. a week for wages, and employed other workmen at 6d. a day, among whom was a John de Coventry, probably the father or grandfather of that John Thornton of Coventry, who, fifty years afterwards, commenced the York window. The ancient process was quaintly pointed out, and the tools of the old workmen described. The croyseur, or cross iron, was one of the tools, and John de Chester was in the habit of paying to Simon le Smyth $1\frac{1}{2}$d. each for them, "and bought as many as seven at a time." Now and then events of local historical interest were found recorded in stained glass, and where such had been preserved they were always of great value. Mr. French here showed an accurate coloured tracing of glass now in the Parish Church of Middleton, the adjoining parish to Bolton. He believed the glass was not originally placed there, but was long ago removed to the church from an old hall in the neighbourhood. It represented a priest and 16 archers kneeling in church, and saying a prayer of thanksgiving for their safe return from the bloody battle of Flodden Field, to which they were led, under the command of Edward Stanley, in the year 1513. Each archer carried his bow over his shoulder, his quiver of arrows at his side, and had his name inscribed over his head. Most of the names were represented by families still resident in and about Middleton. The, sometimes, great difficulty of supporting the large painted windows, and yet shading the iron and leads required, was next pointed out and examples given. For the production of a work of high art in stained glass a combination of qualifications was required. Supposing that the artist was at liberty to choose his own subject, he should so treat it as to harmonise with the sacred character as well as the architectural decoration of the building in which it was to be placed; there should be

solemn repose in the figures, and, as far as possible, no appearance of action. The colours also should please by their harmonious arrangement, rather than surprise and startle by brilliancy of contrast. There were great difficulties in the way of high art in stained glass, though he hoped they were gradually giving way before increasing demand and greater skill. Heraldic subjects were largely used in painted glass. Mr. French then exhibited numerous specimens of old coloured glass, explaining the curious devices with which some of them were ornamented. He then referred to some of the modern improvements introduced into the manufacture, observing that the invention of moulding had been applied in many ways for the purpose of adorning windows, as in a specimen which he exhibited, where the centre was a rich Lancashire rose, which was not cast, as might at first be supposed, from ruby glass. The rose was white glass, but there was placed over it a very thinly blown plate of ruby, which imparted the colour to it; had the rose been cast in ruby glass, it would, from its thickness, show almost black. The three-light window over the communion-table in Christ Church, Bolton-moor, was for the most part filled with moulded glass, and was well worth attention. There could be no doubt that the modern artist and manufacturer would be enabled to introduce numerous effects from the employment of cut crystal and moulded glass far surpassing in gorgeous splendour the utmost efforts of the old masters. At the conclusion of the lecture a vote of thanks was warmly and unanimously accorded to Mr. French.

Royston.—On Thursday, 17th December, Dr. J. C. Daniel delivered a lecture at the Institute, on "The Life and Times of Sir Walter Raleigh."

Slough.—The report of the Mechanics' Literary and Scientific Institution, for the year ending Michaelmas, 1857, speaks of the satisfactory state of the financial department of the Institution. The accounts show a total of receipts from the annual subscriptions of the members and from other sources, amounting to the sum of £150 7s. 11½d., of which no less than £26 1s. 3d. is referable to the fête held in Stoke-park in July last. The whole expenditure for the same period reaches the sum of £141 5s. 3d., which includes £30 laid out in the purchase of books for the library, &c. The Institution at the present time comprises 194 members, and its resources have steadily increased, both in the number of its members, and the amount of its revenue. No less than 140 volumes have been added to the library during the past year. The committee report the continuance and progress of the drawing classes, under the kind and gratuitous superintendance of James Chapman, Esq., assisted by Mr. George Dorrell. Last March five of the members went up to the School of Design, at Kensington Gore, for examination, three of whom obtained prizes. Mr. Chapman is preparing some more of the members for the examination, which will again take place about next March. Early in January the course of practical geometry will re-commence. The committee have much cause for congratulation in directing attention to the drawing class, which forms so important a character in the Institution, and which is so rarely to be found in connection with Institutions of this kind; and the committee gratefully offer their sincere and hearty thanks to James Chapman, Esq., for his great kindness in imparting gratuitously such important benefits to a class who could not otherwise have the opportunity of acquiring so useful a branch of knowledge. The Hon. Secretary, Mr. G. Kershaw, voluntarily conducts a singing class upon the Hullah system. The Institution has this year been admitted into union with the "Bucks and Berks Lecturers' Association," several of whose members will deliver lectures this session. Towards the conclusion of the session of last year, a suggestion was thrown out that in addition to the lectures and other sources of instruction, public readings would materially tend to the edification and improvement of the members, and the committee are happy to announce that they are now engaged in an endeavour to put this suggestion into practice.

MEETINGS FOR THE ENSUING WEEK.

Mon. Entomological, 8.
Tues. Pathological, 8. Anniversary.
Photographic, 8.
Wed. Geological, 8. I. Dr. C. Daubeny, "On the Emanation of Ammonia from Volcanoes." II. Prof. Huxley, "On Pteraspis, a palæozoic genus of Fish." III. Prof. Huxley, "On a new species of Plesiosaurus."
Pharmaceutical, 8.
Royal Soc. Lit., 8½.
Thurs. Zoological, 3.
Royal Society Club, 6.
Philological, 8.
Royal, 8½.
Fri. Astronomical, 8.
Sat. Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Dec.* 25, 1857.]

Dated 20th August, 1857.

2213. George Spill, Stepney green—Improvements in treating fabrics employed in the manufacture of hats, caps, and bonnets, and for other purposes, and also other fabrics, so as to render the same impervious to moisture and grease.

Dated 19th October, 1857.

2668. Marcelin François Cavalerie, 39, Rue de l'Echiquier, Paris—Improvements in obtaining motive power, and in the apparatus connected therewith.

Dated 21st October, 1857.

2687. John B. Slawson, New Orleans, U.S.—An improvement in boxes for receiving the fares of passengers in public conveyances, for the prevention of fraud on the part of the persons authorised to attend to the receiving of the fares as well as on the part of the passengers. (A communication.)

Dated 24th November, 1857.

3935. Emmanuel Octave Bordas, 36, Bond-street—An improvement in billiard cues. (A communication.)

Dated 27th November, 1857.

2958. Samuel Barlow Wright and Henry Thomas Green, Rugby—Improvements in apparatus used in the manufacture of bricks, pipes, and tiles.

Dated 28th November, 1857.

2962. Jules Peters, Eupen, Prussia—Certain improvements in the machinery used in spinning.

Dated 1st December, 1857.

2986. Thomas Jefferson Thompson, Greenwood-park, Newry, Down, Ireland—Improvements in apparatus for lighting railway trains with gas.

Dated 7th December, 1857.

3028. James Stiff, London Pottery, High-street, Lambeth—Improvements in drain pipes.
3029. George C. Greenwell and William Selby, Radstock—An improved machine for washing coals and other minerals, and for separating them from other substances.
3030. James Harris, Hanwell, Middlesex—Improvements in signalling, and in apparatuses employed therein, part of which is applicable to the compression and exhaustion of air and other fluids.
3031. Robert Reeves and John Reeves, Bratton, near Westbury, Wilts—Improvements in implements for depositing seed and manure.

Dated 8th December, 1857.

3032. George Holcroft, Manchester, and George Denholm, Wigan—Certain improvements in steam engines.
3033. Benjamin Shaw, Wellington, Salop—An improvement or improvements in the construction of windows.
3034. Henry Pershouse, Birmingham—An improvement or improvements in stereoscopes.
3035. Edmund Outram, Leeds—An improved steam regulator.
3036. Charles Nightingale, Wardour-street, Soho—Improvements in machinery for feeding hair and fibres intended to be spun or twisted.
3037. Henry Dolman, Nelson-street, Greenwich—An improved stand for "cheval" and other "dressing" glasses.
3039. William Edward Newton, 66, Chancery-lane—Certain improvements in obtaining motive power. (A communication.)
3040. William Rowan, Belfast—Improvements in spinning flax and other fibrous material, in preparing the same for weaving, and in the machinery employed therein.
3041. Richard Archibald Brooman, 166, Fleet-street—Improvements in cocks and valves for regulating the flow of fluids. (A communication.)
3042. Thomas William Willett, 89, Chancery-lane—Improvements in the manufacture of gunpowder and in the machinery connected therewith.

Dated 9th December, 1857.

3043. Charles De Bergue, 9, Dowgate-hill—An improved mode or modes of blowing, feeding, or introducing air into furnaces or other fire-places.
3044. Samuel Clark, 55, Albany-street, Regent's-park—An improvement in wicks for candles and night lights.
3046. Joseph Smith, Walsall, Staffordshire—Certain improvements in securing rails in their respective chairs for railroad permanent ways.
3047. John Haddon, Glover-street Works, Birmingham—Certain improvements in the manufacture of wood screws, a portion of which is also applicable in the manufacturing of certain descriptions of nails.
3048. William Riddle, 4, Stonefield-terrace, Liverpool-road—Improvements in steam engines.

Dated 10th December, 1857.

3049. James Hoddell, Northampton-square, Clerkenwell—An improvement in watches.
3051. Guillaume Ther-Katz, Paris—An improved registering and controling apparatus for hackney-coach and other public carriages.
3052. Isaac Arrowsmith Best, Saint Paul's-square, Birmingham—A new or improved mode of manufacturing printing types.
3053. Samuel Biggin and Joshua Biggin, Sheffield—Improvements in the construction of the handles of tea and coffee-pots, and other similar articles.

Dated 11th December, 1857.

3054. John Chadwick, Manchester, and Arthur Elliott, West Houghton, Lancashire—Improvements in machinery for spinning, doubiing, and throwing silk.
3055. Joseph Tanton, Frederick-street, Caledonian-road—Improvements in shepherd's crooks.
3057. John Stather, Hull—Improvements in producing surfaces in imitation of wood for printing from.
3058. William Denne, County Lunatic Asylum, Bedford—Improvements in apparatus used for lifting patients off beds and other surfaces used for reclining upon.
3059. Nathaniel Richard Hall, Northfleet—An apparatus for registering the phases and age of the moon.
3060. Julius Roberts, St. Leonard's Iron Works, Poplar, and Miles Beale, Surrey-street, Strand—Improved machinery for obtaining and applying motive power, applicable chiefly to the working of ships' pumps, and other mechanism on ship board.

Dated 12th December, 1857.

3061. James Parker, 4, Grove-terrace, Grove-road, Forest-vale, Sydenham—A novel application of steam power for the movement of vessels or other bodies floating on or suspended in water, air, or other fluid, and for moving machinery, and propelling solid bodies on land.
3062. Frederick Walton, Haughton Dale Mills, near Manchester—Improvements in the manufacture of rollers used in machinery for preparing and spinning fibrous materials, and for other purposes where elastic pressure is required, also in the machinery employed in the manufacture of the said rollers.
3063. Francis Puls, Haverstock-hill—A new combination of mineral substances for the production of artificial stone.
3064. William Uren, Redruth, Cornwall—Improvements in machinery for cleaning and dressing minerals.
3065. John de Normann, Naples, and William Thomas Henley, St. John-street-road, London—Improvements in machinery for preventing the overlapping of chains or ropes when used on drums or shafts, which improvements can be applied to the laying of telegraphic cables.
3066. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in photography. (A communication.)
3067. Jean Marie Préaud, 53, Chancery-lane—An improved engine with rotary piston, applicable to various purposes. (A communication.)
3068. Henry Duncan Preston Cunningham, Bury—Improvements in reefing and furling sails.

Dated 14th December, 1857.

3069. John Oldfield, Haughton, Lancashire—Improvements in machinery or apparatus for cutting and separating fur, or hair, or wool, from hides or skins, which said improvements are also applicable to cutting vegetable or fibrous materials.
3070. Horatio Bunting, Colchester—Improved apparatus for obtaining and applying motive power.
3071. Jean Pierre Brignon, 39, Rue de l'Echiquier, Paris—Certain improvements in forging.
3072. William Little, Queen's-road, Regent's-park—Improvements in lamps.
3073. Joseph Parker, Liverpool—Certain improvements in the construction of bedsteads.
3074. Adam Baird, Finchett-house, near Liverpool—Improvements in regulating the supply of water and other fluids for domestic and other purposes.

Dated 15th December, 1857.

3075. James Hogg, junr., 18, St. Andrew-square, Edinburgh—An improvement in the manufacture of "copying-paper."
3076. William Smith, 10, Salisbury street, Adelphi—Improvements in chromotypographical printing presses. (A communication.)
3077. Edgar Breffit, 61, King William-street, City—Improvements in the manufacture of glass bottles.
3078. John Bradley, Huddersfield—Improvements in ovens applicable for baking bread and pastry, roasting or cooking meats, and similar purposes.
3079. James Chadwick, Castleton Print Works, near Rochdale—Improvements in rollers or cylinders for printing or staining the surfaces of woven fabrics, yarns, paper, and other materials.
3080. Edwin Turner, Bradford, Yorkshire, and John Charles Pearce, Bowling, near Bradford—Improvements in the manufacture of railway wheels.
3081. Francis Bedwell, Bathwick-hill, Bath—Improved means of communicating between the passengers and guard, and the guard and engine-driver, upon railways.
3082. George Tomlinson Bousfield, Loughborough park, Brixton—Improvements in the manufacture of cast steel. (A communication.)
3083. William Galloway and John Galloway, Manchester—Improvements in hydraulic presses.
3084. Thomas Howard, the King and Queen's Iron Works, Rotherhithe—Improvements in machinery or apparatus for rolling iron bars used in the construction of suspension bridges and otherwise.
3085. George Allen Everitt, Birmingham—Improvements in the manufacture of tubes or cylinders of copper or alloys of copper.

Dated 16th December, 1857.

3087. James Green Gibson, Cheetham, Manchester, and Samuel Berrisford, Stockport, Cheshire—Improvements in looms for weaving, parts of which improvements are applicable to lubricating bearings generally.
3089. John Marland, Fernlee Vale, near Upper Mill, Saddleworth, Yorkshire—Improvements in apparatus to facilitate the placing of cop tubes on to spindles.
3091. Edwin Hills, Warsash, Titchfield, Southampton—Improvements in the manufacture of white lead, and in the working up of the waste materials.
3093. James Hill Dickson, Stanley-terrace, Rotherhithe—Improvements in machinery or apparatus for scutching and hackling flax, hemp, and other similar fibrous materials.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

3100. John Everard Barton, Kidderminster—An improvement in winding worsted on to the creel bobbins of carpet looms.—17th December, 1857.
3103. James Broad, 149 and 150, Drury-lane—The construction of a pressure or fountain lamp, to burn with safety from ignition in the overflow, and from explosion, all bituminous, carbonaceous, and resinous oils, spirits and naphthas, or admixtures thereof, also the products of Rangoon earth oil, or petroleum, also to adapt all pressure and fountain lamps to burn these substances which are found to ignite in the overflow and cause explosion, &c., in all such lamps as at present constructed.—17th December, 1857.
3111. Samuel Darling, State of Maine, U.S.—An improved pencil sharpener. (Partly a communication.)—18th December, 1857.
3112. Charles Winslow, State of Massachusetts, U.S.—An improvement in the manufacture of "elastic gore cloth."—18th December, 1857.

WEEKLY LIST OF PATENTS SEALED.

December 22rd.

1814. Narcisse Laurent.
1817. Juan Pattison.
1818. James Lawrence.
1821. John Lyon Field and Chas. Humfrey, junr.
1824. John Talbot Pitman.
1826. Isidore Charles Cloet.
1827. William Parsons.
1828. Joseph Alsop and Edward Fairburn.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

December 21st.

2741. John Gray.
2742. Gerd Jacob Benson.

December 23rd.

2724. F.S. Thomas & W.E. Tilley.

December 24th.

5. Stephen Giles.
8. Henri Louis Dormoy.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4036	Dec. 10.	The Tourists' or Expanding Collar	Joseph James Welch & John Stewart Margetson	Cheapside.
4037	„ 28.	Anti-corrosive Inkstand	George Dawler	Birmingham.
4038	„ 29.	Feeding Trough for Pigs and other Animals	David Prosser	Harescomb, Gloucestershire.
4039	„ 29.	The London Shirt Front	Dent, Allcroft, and Co.	Wood-street, Cheapside, E.C.

Journal of the Society of Arts.

FRIDAY, JANUARY 8, 1858.

COUNCIL.

The following gentlemen have been unanimously chosen to fill the vacancies in the Council:

Thomas Dyke Acland.
Dr. Thomas King Chambers.
Thomas Sopwith, F.R.S.
Sir Thomas Phillips.

EXAMINATIONS.—NOTICE TO INSTITUTIONS.

No person who shall not have been for three months previously a member of, or student of, a class in an Institution in union with this Society, can be admitted to the Final Examinations. Moreover, to bring the Examinations within reach of the Members of *Incipient* Institutes and small Evening Classes for Adult Instruction, which cannot afford to pay two guineas for union with the Society of Arts, any Provincial Union or Association, or Local Board for the promotion of Adult Instruction, may unite with itself any number of such incipient Institutions and Small Evening Classes in its district, and give to the whole of them, but *not to fully developed Institutes*, the privileges of Union with the Society of Arts in respect of the Examinations, for a single annual payment of Two Guineas.

EXAMINATIONS AND LOCAL BOARDS.

The following letter has been received from the Mayor of Sheffield:—

"Sheffield, 31st December, 1857.

"Sir,—I beg to refer you to my last, of the 22nd instant, and have now the pleasure to hand you a report of the proceedings of the meeting therein mentioned, and remain,

"Sir, yours obediently,
"ROBERT JACKSON (Mayor)."

The Mayor's Room, Council Hall, Sheffield, 26th December, 1857.

At a meeting of the Educational Institutions (called by the Mayor), and held on Saturday evening, the 26th December, 1857. Present: His Worship the Mayor (in the chair), and deputations from the Church of England Educational Institute, the Working Men's College, the Mechanics' Institute, and the People's College.

It was unanimously resolved, "That two Members of each of the Institutions connected with the Society of Arts in Sheffield form themselves into a joint Committee to carry out the Examinations proposed by the Council of the Society of Arts."

It was further resolved, "That a copy of the above resolution be sent to each of the Institutions here represented."

A vote of thanks was also passed to the Mayor, for his kindness in calling and presiding at this meeting.

COPYRIGHT IN FINE ART.

The following letter has been circulated by the Committee:—

"Society of Arts, Manufactures, and Commerce,
"Adelphi, London, W.C.,
"2nd January, 1858.

"Sir,—A Committee, consisting of the gentlemen whose names are given on the other side,* has been formed by this Society, for the purpose of considering and reporting on the state of the law relating to copyright in works of Fine Art, with a view to obtaining an amendment of it, and I am instructed to lay before you the following resolution, which has been passed:—

"Resolved—That the inquiries of this Committee be directed—

"1st. To ascertain the existing laws of British artistic copyright, and the chief defects of those laws.

"2nd. How those defects affect the interests of producers of works of Art.

"3rd. How they affect the interests of purchasers of works of modern Art.

"4th. How they affect the interests of the public and the promotion of the Fine Arts.

"5th. How they affect the subjects of those Foreign States with whom Her Majesty has entered into international copyright conventions; and what the laws of those States are as affecting artistic copyright.

"6th. To obtain instances of fraudulent or wrongful acts relating to works of modern Art.

"7th. And lastly, to suggest such remedies as appear best calculated to amend the defects of our artistic copyright laws.

"The Committee direct me to call your attention specially to No. 6, in the hope that they may be favoured with the details of such instances as have come within your own experience. The Committee will be glad to receive full and distinct answers on this point. The other points are made known to you solely with a view of showing to what objects the Committee are directing their attention.

"In any instances which you may be able to send to the Committee, the names of individuals may be omitted, if so desired.

"I am, Sir,
"Your obedient servant,
"P. LE NEVE FOSTER,
"Secretary."

THE SEWAGE OF LONDON.

By Henry Allnutt.

"It is impossible for any man with the slightest faith in human contrivance to believe that sewage, containing products that are annually worth not less than £1,000,000 sterling, are ultimately destined to be wasted, while the works we construct for the purpose of throwing it away are a 50 years' debt on the metropolis of a people whose mechanical genius is as remarkable as their wealth is unlimited."—*The Times*, Nov. 17, 1857.

In the *Times* report of the meeting of the Metropolitan Board of Works, on the 23rd November last, Mr. John Leslie (one of the members), alluding to the fact, "that in the proposed scheme for the drainage of London, every one of the sewers would have storm overflows to convey heavy rain-falls to the Thames," said, that this of itself opened the whole question which the Board would sooner or later have to act upon, viz., the separation of the sewage from the rain-fall.

Having carefully examined the Report and Appendix of the Metropolitan Drainage, since the printing of my paper,† dated the 12th November last, I feel convinced that it is perfectly impossible the London sewage can be

* The list of names was published in last week's *Journal*, p. 91.

† See present volume, p. 44.

utilised diluted as it is to its present enormous extent; therefore, while agreeing with Mr. John Leslie in his remarks above quoted, I think we must not stop at the mere removal or separation of the rain-fall, but proceed further, and separate about 17-18ths of the water now considered sewage, from that which is really the offensive portion.

I particularly wish to draw attention to the fact, that as the area of London is covered with buildings, the storm overflows must be more frequent; when the drainage of London is more complete, and the area, instead of being 60 square miles (the present extent), becomes 117 square miles (the area adopted by Mr. Bazalgette), a rain-fall of even 0·05 of an inch, may then prove a storm overflow. As the area is covered with roofs, or the ground paved, the absorption and evaporation will be reduced to a minimum, and therefore we may justly anticipate that an overflow of rain water (from the sewers into the Thames) will occur on so many days in the year that it will materially affect the river, bringing it back almost to its present state of impurity.

Table showing the amount of tons or gallons of water in a rain-fall of 0.05, 0.20, 0.50, and 1.00 inch for the present area of London, compared with the area allowed by Mr. Bazalgette, and also the area determined by the Government referees:—

Fall of Rain.	Amount of Water per acre.		Present Area of London, 60 sq. miles, or 38,400 acres.		Area by Mr. Bazalgette, $117\frac{1}{2}$ sq. miles, or 75,251 acres.		Area by the Gov. Referees, 354 sq. miles, or 226,500 acres.	
Inches.	Tons.	Gallons.	Tons.	Gallons.	Tons.	Gallons.	Tons.	Gallons.
0.05	5 =	1,120	192,000 =	43,008,000	376,255 =	84,281,120	1,132,800 =	253,747,200
0.20	20 =	4,480	768,000 =	172,032,000	1,505,020 =	337,124,480	4,531,200 =	1,014,988,800
0.50	$50\frac{1}{2}$ =	11,312	1,939,200 =	434,380,800	3,800,175 =	851,239,312	11,441,280 =	2,562,846,720
1.00	101 =	22,624	3,878,400 =	868,761,600	7,600,351 =	1,702,478,624	22,882,560 =	5,125,693,440

In the adoption of any scheme for the drainage of London, we should look forward and consider the probable results some years hence. We are now suffering from the effects of carelessness a few years back, in allowing the water-closets to be connected with the rain-water sewers, and I see no way of applying a remedy but that of re-tracing our steps, and doing now what should have been done about 25 years ago, when water-closets were becoming more general; but probably, at that time, so slowly were these conveniences introduced, that there appeared no warrant for the great expenditure in the construction of separate sewers for the conveyance of the excreta, &c., to the river.

It may be noticed that I am rather departing from the view I took of this subject in my last paper, for I there only insisted on permitting the rain water *occasionally* to flow into the Thames. I confess that having subsequently studied the question more closely, I find there is a positive necessity for doing more than merely separating the rain-fall, if we desire to apply the London sewage to the land. I entirely acquiesce in the remarks made by Mr. F. O. Ward, at the meeting of the Society of Arts, 7th March, 1855, reported in the *Journal*, Vol. 3, page 283. He said—

"He agreed with Mr. Lawes that the grand difficulty in dealing with the sewage of London consisted in its vast, and, above all, in its variable, bulk. The average annual rain-fall in London was about 24 inches, equal to about 2,400 tons per acre. The area drained into the sewers was about 26,613 acres, or nearly $41\frac{1}{2}$ square miles on the north side and 18 miles on the south side of the Thames, together about $59\frac{1}{2}$ square miles, of which about half was suburban. A considerable portion of the rain-fall on the latter was absorbed by the ground, but the greater part of that which fell on the paved surfaces (30 square miles) found its way to the sewers. Calculating from these data, and taking the water supply in round numbers at 50,000,000 gallons a day, it might be said that the total quantities of rain-fall and sewage proper were nearly equal, about 80 or 90 million of tons, but the difference was this, that while the sewage was produced uniformly day by day, the rain, on the contrary, was so variable, that two inches or one-twelfth of the whole amount of rain would sometimes fall in one hour, being equal to more than a month's sewage. On the quarter-inch days, the rain-fall was to the sewage as $4\frac{3}{4}$ to 1; on the half-inch days, $9\frac{1}{4}$ to 1; on the inch days, 19 to 1. Now, making all reasonable deductions for evaporation and absorption, it was obvious that the vast and sudden variations of bulk of rain-fall and sewage tended to make the sewage unmanageable. One day in twelve, the rain-swollen brooks would still rush into the Thames, gorging and overflowing the biggest tunnel you could make, and carrying tons of excrement into the tideway you were seeking to purify. In short, he was led to propound this principle, *the whole of the rain fall due to the river, and the whole of the sewage due to the soil.*

Mr. Alexander Leslie, in page 391 of the report, and other gentlemen, advocate the system of having two sets of pipes from a house, one connected with the water closet only, and the other being the present connection of the sewers with the rain waterpipes, and, I would add, with the sinks of the kitchens also. There are some persons who, while allowing that it is very unfortunate that the water closets have ever been connected with the sewers, still maintain that it is out of the question now to remedy it. They admit that were we dealing with a new city, the most proper course would be to construct two sets of pipes or sewers from each house; but as applicable to London, they exclaim, "the time is past, you cannot make an alteration now! If the plan is objectionable it must be persevered in, let the consequences be what they may." Now, I would simply ask, do these parties conclude that London has already arrived at its full growth? Is London to stop at its present area of 60 square miles? nearly half of which is considered by some as still suburban? Has not Mr. Bazalgette treated London as though it were double this extent, namely 117 square miles? And, furthermore, have not the Government referees drawn up a plan embracing 354 square miles for drainage? In point of fact, it is as much as to say, because we have adopted a bad system of drainage on one acre of land, we must adhere to it, and persist in carrying it out acre by acre, whatever may be the future area. We thus actually reverse the natural order of things, and compel the greater to be governed by the less.

Similar arguments were heard when railways were first spoken of; people said we had good roads and canals, and the country did not require railroads,—they would never answer here, where so much money was already invested in roads, but in a new country, such as America, railroads should be adopted; and we well know that notwithstanding the excellence of her roads, this country is proud of her railways, which have spread over the land like the veins in the human body. It is a

self evident truth, that when anything new of real worth presents itself to the world, it matters not what has been employed before it was discovered, the improvement will be sought for, and its general adoption will be irresistible. Again, it cannot be assumed that the whole of the cesspools have even now been converted into water-closets. At the meeting of the Society of Arts, March 1855, (before alluded to in the *Journal*, page 323, vol. iii.,) Mr. Bazalgette said "that at that time 100,000 houses, or one-third of the whole number in London, had been drained into the sewers, and that the conversion from cesspool to water-closets was going forward at the rate of 20,000 per annum;" if in March, 1855, the total number of houses in London was 300,000, and 100,000 had then been completed, from that time to the present (three years) add 60,000; total, 160,000, no less than 140,000 houses have yet to be accommodated in this way; nearly half of London it seems is still without water-closets; if this is a fact, who can assert that it is too late to rectify the error.

That which specially perplexes, and is so objectionable in the present schemes for the drainage of London, is that the ratepayers are called on to pay for works of sufficient magnitude to suit the requirement of London when it becomes double the size, or even much beyond this area. Now in the method or plan which I and many others advocate, we should only have to provide for the present area—the present wants of the metropolis; we should only have to remove the offensive excrement of the inhabitants as far as it is now produced; true, it will be a troublesome work, but at all events we should only deal with the nuisance of the area now occupied by London, and not its prospective area.

Mr. Haywood remarked (page 319, vol. iii., *Society of Arts Journal,*) in reference to Mr. Ward's observations, "that most people would desire the dispolluting the large surface water sewers which were formerly, and still are, small tributary streams, so that they might still discharge into the river Thames, and collecting the sewage by other channels, and discharging it wherever it was desired; but, in the metropolis, he feared it could not be accomplished, the scheme involved double sets of sewers and house drains. There were now about 1,000 miles of sewers in London, and 100,000 houses draining into them; the first thing to be done would be to lay 1,000 miles of other sewers, by the side of those already existing, and 100,000 additional house drains in the houses already having drains."

It is well known that the present main sewers are not by any means judiciously laid out, that they have, in a great measure, been constructed piece by piece, as building progressed, without any regular plan; this can be seen by referring to plate 4, Appendix 3 (Report). Mr. Haywood, I believe, is not correct in saying that the new sewers and pipes from the water-closets "will have to run side by side with the existing sewers," for the new sewers should be laid out regularly, according to a systematic plan, which should be prepared or drawn up with due regard to the levels and fall to the locality to which you desire to conduct the sewage, with the great advantage of a good and cheap supply of glazed earthenware pipes, the cost of putting down these extra sewers will not be so very great, as the sectional area of the new pipes need not be a twentieth of the area of the existing sewers.

If London was divided into nine districts (or as many more as would be found necessary), the works could commence in all the districts at the same time. No enormous bodies of soil, saturated with gas, would be turned up and exposed to the air in the streets, neither would there be a stop put to the traffic, as must be the case if extensive excavations are to be made in the thoroughfares of London; indeed, wherever the deep and large intercepting drains are constructed (one 11 miles long and upwards of 30 feet wide), the neighbourhood will not be bearable from the foul exhalations from the earth; the shopkeepers will be almost rendered bankrupts from the total cessation from business which must ensue while the large works are being constructed. The referees allude to the probability of the *temporary* stoppage of some of the thoroughfares; the diversion of the traffic, and also to the very large quantities of materials and surplus earth which will have to be carted through the streets.—(Report, page 38.)

Then, again, I submit that the lay or direction of the intercepting main drains, in the present scheme for the London drainage, as far as rain water or other water is concerned, cannot be advantageous, the rain water should be removed by the most direct course. The natural hollow or valley passing through London, is that occupied by the Thames, and the rain water should run direct into the river north and south. Instead of the rain water north of Kensington flowing only a mile and a-half into the Thames at Chelsea, it will be conducted in the large intercepting sewer eight miles through the City, towards Bow and Plaistow, and from thence, by another large drain, 39 feet wide, and 16 feet deep, 24 miles in length, to the Sea Reach; total, 32 miles, instead of under two miles. Of course, as I before remarked, at certain intervals, during heavy rains, the storm overflows will permit the surplus rain water to make a short cut direct to the Thames. The rain-water journey through London will intersect about 115 sewers.—(See Report, p. 185.)

With regard to the objection against any altera- of the sewers, from the difficulty of doing such without interfering with the numerous gas and water pipes, there can be no necessity for such a number of pipes in one street, and I beg to urge upon the Metropolitan Board of Works the great necessity of a stop being put to the unlimited laying down of gas and water pipes, especially the former. In the premiums lately given for the best plan of subways, it could not escape observation that one gas pipe and one water pipe, or not more than two of each, were shown in the drawings exhibited to the public at the Society of Arts, and, certainly, under any circumstances, two gas pipes running through a street should be amply sufficient; but what is the fact? Why in Parliament-street (as shown in the Report) there are eighteen pipes, 12 of which number are gas pipes, 4 water pipes, 1 for the telegraph, and 1 drain, beside the sewer. When we further examine the subject, we find that the Chartered Gas Company own 5 pipes, the Equitable 3, the London 3, and the East Gas Company 1. As to the water works, the Chelsea company have 2 pipes, and the Orange-street works two pipes.

In another example given in the report, namely, Bridge-street, there are 16 pipes, thus, Chartered Gas Company, 4; Equitable Gas, 3; London, 3; East Gas Company, 1; total, 11 gas pipes; Chelsea Water Works, 2, and Orange-street, 2; total, 4 water pipes; and 1 telegraph pipe. Rounding the corner of Cockspur-street, opposite Nos. 13, 14, and 15, there are 9 gas pipes, the Chartered Gas Company having 5, Equitable 3, and the London Gas Company 1, with only 2 water pipes. It appears there are upwards of 30 gas and water mains at Charing-cross.

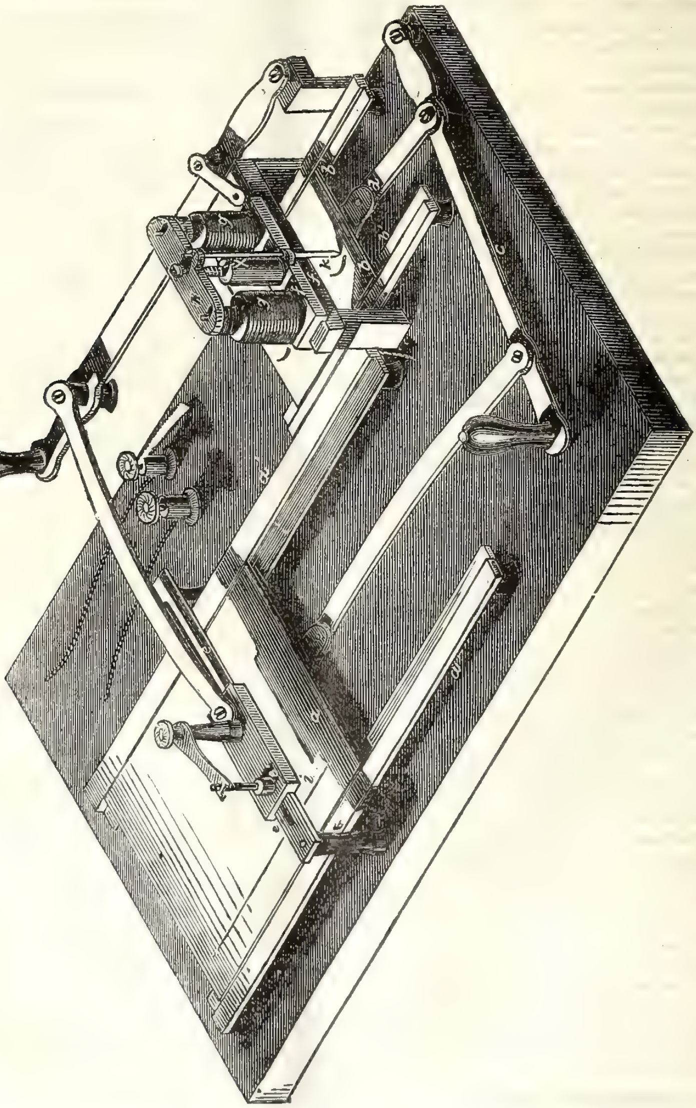
It cannot therefore be a matter of surprise that the streets are continually rooted up; no subways, I believe, would be required if a restriction was placed on laying down pipes. Surely it cannot be an economical, but a very wasteful expenditure for any company to have 5 gas pipes in one street,—it cannot be necessary, and some arrangement should be made to adopt a system of letting a number of streets or a district by contract, to one Gas Company and one Water Company for a certain period. Instead of 16 pipes threading their course through Parliament-street, two pipes would answer every purpose.

ELECTRO-MAGNETIC ENGRAVING MACHINE.

Under this heading, in Vol. II. of the Society's Journal, pp. 485-6 (June 2, 1854), is given the description of a machine invented by Mr. W. Hansen, of Gotha, for copying and for producing an engraved block for surface-printing. The description is illustrated with an engraving of the machine, and prints from actual specimens produced. Improvements have lately been made in this direction. A patent has been taken out by Mr. R. A. Brooman in this country, on behalf of an American gentleman, under the title of "Improvements in machinery in connection with the employment of electro-magnets for producing copies of designs, drawings, patterns or devices, or for regulating and bringing into action a graver by breaking and closing an electric circuit in accordance with some previously prepared design or figure."

The following description is taken from the *Mechanics' Magazine* of the 2nd inst.:—

The passage of the design or figure under a "style" effects the breaking and closing of the circuit, and thereby brings into action the graver situated at a distance, but moving in a regulated manner and governed by the action of the style, whereby movements will be imparted to the graver at the moment of the breaking and closing of the circuit. The simplest form of this invention, whereby the general view may be had of its scope and design, is represented in the engraving annexed, and consists in having two metal plates, *a* and *b*, one of which, *a*, is a



conductor of electricity. These plates are placed at a short distance apart, each plate moving in guide frames, *a* and *b*, lying parallel to those of the other. These plates are connected by a lever, *c*, so that a movement of one plate transmits a similar movement to the other along these guides. One of these plates, as *a*, will have upon it the pattern which is to be copied, and the other, *b*, is the plate intended to be engraved according to the pattern. If the design is to be on a reduced scale, then this latter plate will be moved by a link, *d*, placed near to the fulcrum of the lever, its movements in its guides being reduced accordingly, and *vice versa*; if enlarged,

its link will be arranged to work from the long end of the lever. Centrally placed over the paths of each of these plates are two other sets of guide-rails, *e* and *f*, striding the first-named guides at right angles. That at *e*, over the pattern plate, has a slide into which is fixed a pointed style, *i*, placed vertically, its point resting upon the pattern plate beneath. Upon the guide, over the other plate, is affixed also a slide, *f*, upon which is a helix, *g*, with magnets, and an armature, *h*, placed properly for being actuated in the usual manner of electro-magnets. The armature has affixed to it a graving tool, *k*, standing vertically, having its cutting edge when the armature is not in contact with its magnet, just above the surface of the plate to be engraved. The slide, *e*, having the style *i* in it, and the slide *f*, with the magnetic armature, &c., are also connected together by a lever, *l*, so that the movement of one will produce a like movement in the other, or with the proportional differences of motions, if arranged for enlarging or diminishing, as before stated for the plates. A galvanic battery is now put in connection in such way that one pole thereof will be connected to the pattern plate, and the other pole to the style over that plate, so that whenever the style touches the pattern plate, the circuit will be broken, and when passing over any conducting substance on it will be closed. The effect of this upon the graver is to produce a like action, the closing of the circuit bringing the armature, *h*, upon the magnet which brings the graver, *k*, upon the plate *b*. Now, if while the circuit is closed the pattern plate *a* be moved a certain distance, then will a line be engraved upon the plate *b*, in accordance with the extent of its movement. By coating the pattern plate with some non-conducting material, as varnish, and drawing thereon down to the metal any device, a copy may be engraved by moving the plates and style in the following order:—First, bring the style, *i*, to one side of the pattern plate, the graver, *k*, will also thereby be transferred to one side of its plate. When the style, as the plate is being moved, comes into contact with it, the circuit will be immediately closed, and the graver will also be brought to press upon its plate; the pattern plate now being drawn along, a straight line will be engraved upon the plate *b*, until the style on *a* strikes a place varnished, when the circuit will be broken, and the graver will be lifted off its plate during the passage over the varnished surface. On leaving that the circuit will again be closed, and the graving go on again; this interruption taking place as often as a portion of the pattern plate is intercepted during the passing of that plate under the style. The style is to be lifted up, and the pattern plate returned to the first position, then the style moved the distance across for a next line, and the operation repeated. Thus, the whole plate will be gone over in parallel lines, and the plate *b* in like parallel lines, whereby in those places in which the circuit has been broken by the figures, this plate will accordingly have been engraved in fac-simile if the movements of the two plates have been alike, or will be enlarged or diminished, if actuated as already stated.

Instead of operating the graver directly by the armature and magnet, the inventor proposes various modifications in which this may be accomplished, by the armature setting in operation some suitable machinery according to the breaking and closing of the circuits by the pattern. The use of the invention may also be extended to carving, weaving, etc.

SOCIETY OF ARTS AND OXFORD EXAMINATIONS.

As the Council of the Society of Arts, "with the view of assisting to bring the proposed title of 'Associate in Arts of Oxford' within the reach of the members of Institutes in union with this Society," have notified that they "will grant to each youth, not less than 16 or more than 18 years of age, who shall obtain, in 1858, three of the Society's certificates of the first class in the subjects contained in the Oxford programme, the sum of £5 towards his expenses, if he attends at the University and undergoes the Examination there," it is thought useful to publish, for the guidance of the members of Institutes in Union, those portions of the Oxford regulations to which the offer of the Council has reference.

Examination for the Year 1858.

The Examination will commence on Monday, the 21st of June, 1858.

Examination of Candidates for the Title of Associate in Arts.

Candidates must be under eighteen years of age on the day when the Examination begins.

I. All candidates at this Examination will be required to satisfy the Examiners in

1. Analysis of English sentences and parsing, and correction of faulty sentences.
2. A short English composition.
3. Arithmetic.
4. Geography.

Every candidate will be required to draw from memory an outline map of some country in Europe to be named by the Examiners, showing the boundary lines, the chief ranges of mountains, the chief rivers, and the chief towns.

Questions will also be set in Geography.

The outlines of English History: that is, the succession of Sovereigns, the chief events, and the characters of the leading men in each reign.

*II. The Examination in the Rudiments of Faith and Religion will consist of questions in

1. The Historical Scriptures of the Old Testament to the Death of Solomon.
2. The Gospels of St. Matthew and St. John, and the Acts of the Apostles.

Those who offer themselves for examination in Greek will be expected to answer questions on the same parts of the Greek Testament.

3. The Catechism, the Morning and Evening Services, and the Litany; and the outlines of the History of the Book of Common Prayer.

III. Every Candidate will also be required to satisfy the Examiners in two at least of the Sections marked A, B, C, D, or in one of those four and in one of those marked E, F.

Section A.—*English.*

This will include questions in

1. English History, from the battle of Bosworth Field to the Restoration; and the outlines of the History of English Literature during the same period.
2. Shakspeare's King Lear, and Bacon's Essays.
3. The outlines of Political Economy and English Law.

The Examination will not extend beyond the subjects treated of in the first book of Smith's Wealth of Nations, and the first volume of Blackstone's Commentaries.

4. Physical, Political, and Commercial Geography.

A fair knowledge of one of these four classes of subjects will enable a candidate to pass in this section.

Section B.—*Languages.*

1. Latin. 2. Greek. 3. French. 4. German.

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* This Examination will not be required of any Candidate whose parents or guardians shall have declined it on his behalf.

A fair knowledge of one of these languages will enable a Candidate to pass in this Section.

Section C.—*Mathematics.*

1. Pure Mathematics.
2. Practical Mechanics (including Mechanism) and Hydrostatics mathematically treated, Surveying, and Navigation.

Algebra to the end of Quadratic Equations and Four Books of Euclid will enable a Candidate to pass in this Section.

Section D.—*Physics.*

1. Natural Philosophy.

Great importance will be attached to good Mechanical drawing.

2. Chemistry.

Questions will be set on the facts and general principles of Chemical Science.

There will be a practical examination in the elements of Analysis.

3. Vegetable and Animal Physiology.

Questions will be set on Vegetable Physiology in general, and on the functions of Vertebrata in Animal Physiology.

Parts of plants and bones of Vertebrata will be given for description.

Great importance will be attached to good Botanical and Anatomical drawing.

A fair knowledge of one of these classes of subjects will enable a candidate to pass in this section; but in all cases a practical acquaintance with the subject-matter will be indispensable.

Section E.—*Drawing and Architecture.*

1. Drawing from the Flat, from Models, from Memory, and in Perspective; and Drawing of Plans, Sections, and Elevations.
2. Design in pen-and-ink, and in colour.
3. The History and Principles of the Arts of Design.

A fair degree of skill in free-hand drawing will be required in order that a candidate may pass in this section.

Section F.—*Music.*

1. The Grammar of Music.
2. The History and Principles of Musical Composition.

The Elements of Thorough Bass will be required in order that a Candidate may pass in this section.

Separate lists of those who distinguish themselves will be published for each of the Sections A, B, C, D, E, F, arranged in two divisions.

The names in each first division will be arranged in order of merit; those in each second division alphabetically.

The names of other successful candidates will be printed in a general alphabetical list.

After each successful Candidate's name will be inserted his age, the place of his residence, and the school (if any) from which he comes to attend the Examination.

Every candidate who passes will receive the Vice-Chancellor's Certificate conferring the title of Associate in Arts, and specifying the subjects in which he has satisfied the Examiners.

The fact that a candidate has passed the Examination in the Rudiments of Faith and Religion will be entered on his certificate, although it will not affect his place on the list.

Place of Examination.

The Examination will be held in Oxford, and simultaneously in other places, if it be requested and found expedient.

Local committees wishing to have an Examination in their several districts may obtain all necessary information from the Rev. J. E. Sewell, New College, Oxford.

Time of Applying.

Candidates desirous of being examined at Oxford must apply on or before the tenth of April, 1858.

Local committees desirous of having Examinations held in their several districts must apply on or before the 1st of March, 1858, specifying the probable number of their candidates.

The names of these candidates must be transmitted to the Rev. J. E. Sewell on or before the tenth of April, 1858.

Fees.

Every candidate will be required to pay a fee of 30s.

These fees must be paid on or before the 10th of April, 1858.

SOUTH KENSINGTON MUSEUM.

Christmas Holidays:—Morning, 14,343; Evening, 9,168. Total, 23,511.

Home Correspondence.

THE APPLICATION OF THE SEWAGE OF TOWNS TO AGRICULTURE.

Sir,—In the *Journal* of the 11th December appears a letter from Mr. Edwin Chadwick, accusing M. Barral of very "serious misrepresentations," of "intrinsic ignorance," &c., &c. Mr. Chadwick speaks as if he were replying to a short extract from the *Journal d'Agriculture Pratique*, which was translated into *Bell's Weekly Messenger*, and copied into your columns in September last.

Permit me, in the first place, to state that Mons. Barral, whom Mr. Chadwick treats in so contemptuous a tone, speaks on all scientific agricultural questions with authority. He was the official reporter of the Imperial Government at the Agricultural Department of the Great French Exhibition of 1855, thus occupying the same position as the late Mr. Pusey, President of the Royal Agricultural Society, did in England in 1851. Let me further say, that the *Agricultural Magazine* which he edits is certainly second to no periodical on the same subject in any language—that the most eminent agriculturists in France contribute to its pages. As to Mons. Barral's personal character, he is well known to most of those Englishmen who took an active part in the last two French Agricultural Exhibitions in Paris, as a most able, exact, painstaking, conscientious man, entirely devoted to the cause of scientific truth, remarkable, too, for having always kept aloof from commercial speculation of any kind.

Mons. Moll, the French Commissioner, is one of the contributors to the *Journal d'Agriculture Pratique*, and he has published in it statements of the profits to be derived from the use of liquid manure and sewage manure, in which he has taken nearly all his facts and figures from the publications of the late Board of Health; for Mons. Barral's journal is impartially open to the free discussion of every agricultural question.

Mons. Barral, accompanied by Mons. de Guaita (who having passed two years in a Lincolnshire farm as an amateur, speaks English perfectly), came over to the Royal Agricultural Society's show at Salisbury, in July last, and then, having previously accepted as correct the statements as to the profitable value of sewage manure and liquid manure, made by Mr. Chadwick, Mr. Ward, and their translators, proceeded on a visit to the principal liquid manure farms of Scotland and England. Of these visits he has published exact detailed reports in his *Journal* of the 20th August, 20th September, and the 5th of October, 1857, illustrated with woodcuts, to which I call the attention of those interested in the liquid manure and sewage manure questions. The following brief account of their mode of preparation and

contents of these reports, will show how very unlikely Mons. Barral was to make any mistake, and how impossible it is that the mistakes, if any (which I deny), were intentional. Mons. Barral begins by "translating literally the passage devoted to Canning-park farm, from a report published by the Board of Health, dated 31st December, 1851," and he observes, "it is evidently from this official report that Mons. Moll and Dr. Harsteen have derived the greater number of the details as to Canning-park, as may be seen by reference to the *Journal d'Agriculture Pratique*, 20th July, 1852, and 20th February, 1857." He then proceeds, "We will now compare the preceding text with the literal account (*procès verbal*) of the visit which, in company with Mons. de Guaita, we made to Canning-park on the 7th August, 1857. This *procès verbal* was drawn up the same evening, with no other information before us than the notes taken during our conversation with Mr. Telfer, who most obligingly gave us all the details in answer to our questions on his curious mode of cultivation." "Mons. de Guaita," he adds, "testifies to the exactness of the following *procès verbal*." Then follows a most minute and interesting description in detail of every part of the management of the Canning-park dairy farm (for which I refer your readers to the original work in French); and the report terminates with the general conclusions, which have already appeared in your *Journal*, with some further comments from the editor of *Bell's Messenger*, which called forth Mr. Chadwick's letter.

Mr. Chadwick admits that Mr. Telfer *does use the large amount of artificial manure* described in Mons. Barral's report, to produce the great crops described in the Board of Health blue-book, but he states that as Mr. Telfer is a manure merchant, he is inclined to exalt the "powers of the manures he could sell, at the expense of those he could not sell." I am content to leave that argument, for what it is worth, to the consideration of your readers.

Mr. Chadwick also complains that M. Barral quotes from the report of Mr. Lee, and not from that of the Board. This is a strange objection. Mr. Lee was one of the inspecting engineers of the Board of Health, specially deputed to report to the Board on a number of liquid manure farms. At page 448 of the 3rd vol. *Journal of the Society of Arts*, you will find Mr. Chadwick quoting Mr. Lee's tabular statement of the cost of laying down pipes and pumps, in support of the tubular system of liquid manuring against the water-meadow system now adopted by Mr. Austen, the present engineer of the New Board of Health; and at page 498 of the same volume, answers, showing that not one farm described by Mr. Lee produced a profit.

Mr. Chadwick then proceeds to protest against Mons. Barral terming Myer Mill Farm, lately managed by Mr. James Kennedy, for his cousin Mr. P. W. Kennedy, the manager of a branch of the Royal Bank of Scotland, "the ruined farm of Myer Mill." At any rate, if Mons. Barral was wrong, he was misled by the universal evidence of all Mr. Kennedy's neighbours, and of Mr. James Kennedy himself, who admitted, two years ago, to one of the most distinguished Aberdeenshire farmers, whom I will name if pressed, that *the farm never did pay*. I am a bad hand at writing the Scotch dialect, but the words of James Kennedy's mother, in my note book, taken down in Paris, during the Agricultural Exhibition, from my Scotch friend, were as nearly as possible these:—"Jemmy, ye may as weel tell the honest man the truth, its a sad bargain the farm." The *Agricultural Gazette*, conducted by one of our ablest agricultural writers, Mr. J. C. Morton, not only stated, at least a year ago, the failure of the Myer Mill farm, but accounted for it by the too great extension of the pipe system. M. Barral, many months later, visited the farm, and found the costly pumping apparatus silent. Mr. Chadwick follows later still. The pumps were still silent. You may remember, on the discussion of Mr. Fothergill Cook's paper, I stated that the farm was vacant. Is it at work now, or are the boilers still under repair? The tenant or manager has gone south. None of these facts are consistent with success, and yet Mr. Kennedy, the banker, is not unnaturally indignant that his hobby should be termed a failure. Now, Mr. J. C. Morton read a paper at our Central Farmers' Club, in March, 1851, describing these two farms, for the purpose of drawing attention specially to the use of liquid manure in growing Italian rye grass, which is certainly the most profitable use to which that form of manure can be applied. In this paper, Mr. Morton gives an account of Mr. Telfer's farm, which is substantially the same as that given by Mons. Barral, as will be seen in the following extract from the Report circulated among the members of the club:—

"Immediately after cutting the rye-grass, between 3 *and* 4 *cwt. per acre of mixed Peruvian guano and sulphate of ammonia are sown* upon it, and one inch, or 100 tons per acre of ley water are poured through pipes, containing such share of the liquid excrement of 48 cattle as belongs to the period since the last pumping. Mr. Telfer lets the water on direct from the pipes to the land; *he does not send it flying in a stream through* 40 *or* 50 *yards of dry air, which would run off with half its excellence*, but he sends it directly to the roots of the plants. Three cuttings up to October, each followed by a washing-in of artificial manure, to the extent of from 3 to 4 cwt. per acre, so that "during the two years that will have yielded 100 tons of green food per acre, in seven cuttings, *by the use of* a ton of guano, sulphate of ammonia, and nitrate of soda, washed in with a hundred tons of dilute liquid." Nothing about wheat here!

In describing Mr. Kennedy's farm, Myer Mill, Mr. Morton mentions that he purchased from 800 *to* 1,000 *gallons of gas-water* (ammoniacal liquor), at 6d. per gallon, and applied it with the liquid of 150 cattle and the manure of 450 sheep, kept on boards, to 84 acres of Italian rye-grass, out of 900 imperial acres, 420 of which were under the system of under-ground irrigation. "*Seven thousand cubic yards of solid manure used for the arable crops*."

But I have another piece of evidence about Mr. Kennedy's farm, from the "*Troisième Voyage Agricole en Angleterre et Ecosse*,*" par le Comte Conrad de Gourcy, which took place in 1851, and was published in 1855. He says, at page 176, "La fameuse ferme de Myer Mill appartient à M. Kennedy. Celui-ci l'a loué à une personne portant le même nom, ayant le gout des experiences et faisant faire des travaux immenses dans cette ferme, *mais M. Kennedy a assuré le fermier que si ses ameliorations n'etaient pas profitables, il n'en souffrirait pas.*"

Now, as Mr. Kennedy the banker was to bear all the risk of Mr. Kennedy the farmer, it is not diffcult to understand that the next tenant might, as Mr. Chadwick states, pay double rent, and yet not pay a heavy rent.

I think I have given above conclusive evidence that Mons. Barral has made no misrepresentation in his description of the liquid manure farms. He read, in the works of the Board of Health, and in the papers read by Mr. Chadwick and Mr. Ward, at Brussels, of extraordinary things done with liquid manure and liquid sewage; he came, saw, and questioned, and found the only brilliant results in artificial *grass crops obtained by the liberal use of guano and other expensive substitutes*. He found no crops of wheat grown with liquid manure; he looked in vain for forty bushels an acre from the sewage of Rugby, or twenty bushels, or even ten. So he wrote down what he saw, and I confess that his exact matter of fact detailed statements, printed, as they are, side by side with the Board of Health Reports, are very provoking.

As to Rugby, it is true, as Mr. Chadwick stated, that Mr. Campbell, under his lease, pays a heavy rent to Mr. Walker for part of the sewage of Rugby, but it is also

* Libraire Agricole de Dusacq, Rue Jacob, 26.

true that Mr. Campbell declares, "that the people of that town use so much water that the stuff is perfectly worthless; that he is very much disappointed with his bargain, and is obliged to strengthen his liquor with a large quantity of purchased manure and gas water."

Mr. Chadwick talks of Mons. Barral's "intrinsic ignorance." I ask your readers to compare the reports of the *Journal d'Agriculture Pratique* with the papers of the Board of Health, and the letters of Mr. Chadwick, and then decide on which side lies the balance of testimony as to the profitableness of using liquid sewage manure; for on the *profitableness* the whole question turns.

On the remarks about the circumstances that led to the fall and re-construction of the Board of Health, it is not necessary to say anything in this, a scientific journal, except that the printed evidence with respect to Southampton bears out all that Mons. Barral asserts as to the unpopularity of that Board *after* the works executed by its engineers were at work.

One word more. Mr. Chadwick assumes that all those who, like myself and my friend Mons. Barral, differ with him as to the profitableness of liquid sewage manure, and as to the policy of expending vast sums for its distribution, all those who consider that in this climate the application of liquid manure of any kind must be limited, as it is in Italy, to grass crops (rice excepted), are not only stupidly blinded by "indolence and pride," but "obstructors of labours directed to the prevention or mitigation of some of the heaviest inflictions on mankind." But this is begging the whole question. The projectors of the last flying machine, the promoters of that terrible failure, the atmospheric railway, the devotees of a great man who put faith in a steam coach for common roads, all argued in the same style. My friends, agricultural and engineering, are as desirous of promoting the progress of agriculture, and the thorough cleansing of towns from sewage, as Mr. Chadwick.

I am, &c.,

S. SIDNEY.

Central Farmers' Club.

P.S.—Since writing the preceding, I have received a letter from Mr. B. Congreve, the tenant, *on lease*, of the Rugby sewage farm, in which he says, "I am more and more convinced that sewage is of *no use* upon arable land; in fact, in its present state, it is a positive injury."

LORD PALMERSTON'S MORTAR.

Sir,—The partial failure of this colossal mass of wrought-iron staves and hoops must be my excuse for requesting the favour of a small space for the following statement.

In January, 1855, when our guns and mortars were bursting daily in the Baltic, and at the memorable siege of Sebastopol, as well as at the experimental trials in the marshes, I had the honour of laying a plan before the War Department for the construction of what may be fairly called indestructable ordnance, and was referred by that department to the "Ordnance Select Committee" at Woolwich.

I attended upon that committee and explained the plan, which was to construct all large ordnance with a soft steel spiral bore, of sufficient strength to resist the explosion, upon which should be cast a metal jacket of brass or iron, in order to give mass and weight to resist recoil. I also explained the method of readily forming and welding the spiral coil for the bore, and showed that such ordnance could be made as quickly, and nearly at the same cost, as those in ordinary use, as well as that such ordnance would present the same form, dimensions, and weight, and would be equally adapted for every species of projectile.

The "Select Committee" were prevented by their regulations from acceding to my proposal, viz., to construct a small piece of ordnance on my plan in the Royal Arsenal, with the means and appliances then at the disposal of the Select Committee, free of any charge for my personal superintendence, and they also refused to accept a small experimental model such as my own resources might enable me to construct, and they further decided that they could not entertain my plan unless I produced for the purpose of experiment a full-sized 68-pounder at my own cost and charge, a condition with which of course I was unable to comply. At the same time the Select Committee also required me to make a declaration renouncing any claim for fee or reward in the event of a successful result.

A writer in the *Times* of Monday, the 21st ult., under the head of "Mortars and Mortars," is perfectly correct in denouncing all monster masses of wrought iron, as forged by means now at our command, as monster failures. What proportion does the largest steam-hammer bear to a monster gun, compared with that of a blacksmith's hand-hammer in forging a tenpenny nail? Besides this, all structures consisting of a system of staves and hoops, however ingeniously put together, must derive their whole strength from the hoops alone, and none whatever from the staves, which merely form a useless load of iron.

I am, &c.,

HENRY W. REVELEY.

Poole, January 2nd, 1858.

Proceedings of Institutions.

Hobart Town, (New South Wales.)—The secretary of the Mechanics' Institution, in a letter lately received, says:—"Our Institution is progressing favourably, in spite of the great depression of trade here. We have about 400 members. A chemistry class is in operation, and is attended regularly by 35 members. A singing class is also being conducted with success."

Holbeck, near Leeds.—On Thursday, the 17th of December, 1857, the Rev. J. H. F. Kendall delivered an extempore lecture at the Church Institute, "On the Atmosphere." The lecturer confined his remarks to the mechanical properties of the atmosphere, and made several experiments to illustrate his subject. The lecture was of an interesting and practical character. The audience, composed almost exclusively of working people, paid marked attention to all that was stated by the lecturer. Mr. Kendall has undertaken to deliver a second lecture, on the different gases which enter into the composition of atmospheric air.

Liverpool.—On Thursday morning, the 22nd of October, a meeting of the life governors, directors, and other friends of the Collegiate Institution was held in the lecture hall, to celebrate the "Founders' day." On the platform were the following, amongst other gentlemen:—The Right Hon. W. E. Gladstone, M.P.; Wm. Brown, Esq., M.P.; Pudsey Dawson, Esq., of Hornby Castle; Rev. Dr. M'Neile, Venerable Archdeacon Jones, Rev. J. H. Jones, J. Jones, jun., Rev. Mr. Appleton, Rev. C. W. Lawrence, Rev. J. King, Rev. D. Anderson, Rev. J. Stewart, E. Jones, Esq., &c. The Rev. J. S. Howson delivered an address, in which he stated that the foundation stone of the building was laid on the 22nd day of October, 1840. Many of those who combined to establish the Institution were happily surviving to see their wishes, or at least a great part of their wishes, accomplished, though they had to mourn the loss of some who would have sympathised with them in this anniversary. Mr. Howson enlarged upon the history, objects, and influence of the Institution, and was followed by the Right Hon. W. E. Gladstone, M.P., who spoke at some length, expressing the cordial interest he felt in the welfare of the Institution.

OXFORD FREE LIBRARY.—Some interesting statistics of the Oxford Free Library, prepared by Mr. Dewe, the librarian, have just been issued for the quarter ending Nov. 30, 1857. The results are generally of a satisfactory character, and show a great increase over the preceding summer quarters, both in the number of visitors and readers. The number of daily visitors for the quarter is 32,325; total number of book readers 5,860, of which 3,822 were novels and tales; 1,135 poetry, the drama, and miscellaneous literature; 491 history, travels, and biography; and 412 theology, philosophy, science, and art. The average number of daily visitors during the quarter was 403; daily book readers, 64; and Sunday evening visitors 70. The library now contains 4,550 volumes. A separate statement has also been issued, showing the operation of the lending library for the month of November. The total number of volumes in this department is 1,025, and the estimated number of borrowers' cards issued 191. 298 persons have applied for books, and 297 volumes have been issued, of which 270 were novels and tales; 59 poetry, the drama, and miscellaneous literature; 59 history, travels, and biography; and 9 theology, science, &c.

POOLE.—On Tuesday evening, Nov. 24th, Mr. Joseph Darby, of Lytchett, gave a lecture at the Town-hall, in connection with the Mechanics' Institute, on the "Works of Charles Dickens, their Moral and Social Influences." Mr. Darby gave a lecture on this subject last year, and the present lecture was a continuation of the review of Dickens' writings. The chair was occupied by Mr. W. Mate.

YARMOUTH.—The fourth annual report of the Parochial Library and Museum shows that the increase in the number of members is very satisfactory. In the year ending October, 1856, there were 320; there are at present 470, the increase for the past year being 150. The balance-sheet shows, in consequence, a rise in the subscriptions to the library, from £28 12s., the amount received in 1856, to £42 13s. 9d., the receipts for the past year. This may be attributed partly to the effects of the early closing movement, partly to the attractiveness of the lectures and musical evenings, and partly to the festival held at the Christmas anniversary. The library now numbers 2,772 volumes, showing an increase of 149 during the year. The state of the finances authorises the Committee to recommend that a further sum be at once laid out in the purchase of books. The issue of books to subscribers has been 6,635; and including the book-club circulation of 4,120, we obtain a total of 10,755 books issued. Books of reference and other works have been extensively used in the reading-room. The following are the number of volumes of each class of books circulated during the year:—Arts, science, trades, manufactures, 170; anatomy, 9; biography, 280; dictionaries, encyclopædias, 14; education, 24; fiction, 1,320; geography, 870; geometry, 7; history, 578; literature, 109; miscellaneous, 155; natural history, 100; periodicals, 580; poetry, 135; political economy, 71; physical science, 80; theology, 485; juvenile library, 1,648; total, 6,635. 7,750 has been the total attendance at the reading-room, being an average of twenty-five a night, and the committee foresee that they will shortly have to turn their attention to increased accommodation. To meet the wishes of many of the members, the book-club has been divided into two branches, the one circulating books weekly, the other fortnightly. The number of subscribers are, to the weekly, 72; to the fortnightly, 21; total, 93. The lectures were, for the most part, delivered gratuitously, and the attendance has proved how much they were appreciated, not only by the members, but by the residents generally. The lecture session commenced on the 30th September, 1856, and closed May 5th, 1857, during which the following were delivered:—Sept. 30, 1856, "Early Closing: Time and the Kalendar" (dissolving views), Rev. G. Hills, B.D.; Oct. 14, "British Navy" (diagrams), Rev. G. Pellew, B.A.; Oct. 28, "Paris" (dissolving views), Rev. N. T. Garry, M.A.; Nov. 11, "How we Breathe, What we Breathe, Why we Breathe" (diagrams), Rev. A. H. Locock, M.A.; Nov. 20, Musical Evening, conducted by Mr. H. Stonex; Nov. 25, "Nineveh" Part I. (diagrams), Rev. T. Hammond Tooke, M.A.; Nov. 27, ditto, Part II.; Dec. 9, "The Templars" (dissolving views), Rev. E. Yates, M.A.; Dec. 23, "Curiosities of Insect Life" (diagrams), E. Wheeler, Esq., C.E.; Jan. 20, 1857, "The Late War in the Crimea," Rev. H. P. Wright, M.A.; Feb. 3, "Venice" (dissolving views), R. H. I. Palgrave, Esq.; Feb. 12, Musical Evening, conducted by Mr. H. Stonex; Feb. 17, "Olives and Maccaroni," Rev. M. Mitchell, M.A.; March 8, "Ancient and Modern Rome" (diagrams), Rev. H. Dupuis, B.D.; March 17, "The House we Live in, and how to take care of it" (diagrams), Rev. M. H. Beaumont, M.A.; March 31, "Holy Places" (dissolving views), Rev. G. Hills, B.D.; April 14, "The Highlands of Scotland" (dissolving views), Rev. Dacres Olivier, M.A.; April 21, the same repeated; April 28, "Cairo and the Pyramids" (dissolving views), Rev. G. Hills, B.D.; May 5, the same repeated. Every year adds something to the interest of the museum; the branch of it which is best represented is ornithology. The whole collection of specimens have been classified and arranged as much as possible during the past year. With reference to the evening classes, free instruction has been given as usual in reading, writing, and arithmetic, to adults of the working classes. The school opened on the 3rd October, 1856, and closed 1st May, 1857. The average attendance was 29, and the total number of those who availed themselves of it was 89. Classes were opened last year on the following subjects:—Ecclesiastical History, English History and Literature, English Composition and Writing from Dictation, French, Latin and Roman History, Mathematics, the Elements of Navigation, Vocal Music, and Short Hand. The Committee hope ere long that some of the members may be found sufficiently advanced to attend the Examinations of the Society of Arts with good hope of success. Meanwhile, the Committee offer prizes in each class. The attendance at the French class was, male class, 15; female class, 8. For the mathematical class 28, for the music class 31 names were entered. The Mutual Improvement Society has been revived, under the care of a sub-committee; its operations will extend to debates on given subjects, rehearsal of speeches from the best English authors, essays on given subjects, and the like. As an additional stimulus to mental cultivation, the Committee offer a prize of £2 for the best, and £1 for the second-best essay, to be competed for by clerks in offices, and assistants in shops, whether members or not of the Institution. In consequence of a resolution passed at the last annual meeting, a Committee was formed to put in practice, as far as possible, the principles of early closing. The Committee named, met with a success which had never attended any similar attempt in former years. The drapers, grocers, stationers, almost unanimously, and some others, closed their shops at 7 o'clock, from November to April. It will be the earnest endeavour of the Early Closing Committee to re-establish and extend the benefits of this important movement during the approaching winter. A Christmas Exhibition and Entertainment was given with great success. The programme of the entertainment promised fifteen lectures; four or five of these were given each morning and evening, in order that visitors, either in the morning or evening, might hear the whole course, and yet have time to examine the exhibition. The collection of pictures included specimens of many of the best masters. The best thanks of the Committee, and indeed of every visitor, are due to all contributors to this manifold entertainment, and to all who assisted in the arrangements.

Miscellanea.

Vaccine Lymph in Glycerine.—Dr. Andrews, of Chicago, has made some successful experiments in the preservation of vaccine virus by solution in glycerine, using the solution instead of the solid matter. The solution was kept for two or three months in warm weather, when seven cases were vaccinated without a single failure. The scab should be broken into three or four pieces, and thrown into a little glycerine, which is to be occasionally shaken; it dissolves slowly without other care.—*Amer. Journ. of Med. Science*, Oct., p. 561.

MEETINGS FOR THE ENSUING WEEK.

Mon. Society of Arts, 6. Conference of the Representatives of the Metropolitan Institutions.
Architects, 8. I. Mr. M. Digby Wyatt, "A few Notes on the Crannoges or ancient Lake Castles of Ireland." II. Mr. Gordon M. Hills, "A Review of the Architecture and History of the Round Towers of Ireland."
Geographical, 8½. I. Lieut.-Col. Waugh, "On Mount Everest and Deodhanga." II. M. Pecherof, "Description of the Amur River, in Eastern Asia." III. Report of the Expedition up the Niger under Dr. Baikie and D. J. May, Esq., R.N., &c.
Tues. Syro-Egyptian, 7½. The Rev. Dr. Hewlett, "On the Natural History of Egypt."
Civil Engineers, 8. I. Mr. Locke, M.P., President, "Address on taking the chair." II. Mons. Guérin, "On Railway Brakes."
Med. and Chirurg., 8½.
Zoological, 9.
Wed. Literary Fund, 3.
Society of Arts, 8. Mr. J. Baily Denton, "On the Advantages of a Daily Register of the Rain-fall throughout the United Kingdom, and the best means of obtaining it."
Graphic, 8.
Microscopical, 8.
Archæological Association, 8½.
Thurs. Royal Society Club, 6.
Antiquaries, 8.
Royal, 8½.
Sat. Asiatic, 2.
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Jan.* 1, 1858.]

Dated 19th October, 1857.

2666. Jean Schmidt, Essex-street, Strand—An improved method of making tyres for railway wheels.

Dated 3rd November, 1857.

2786. Peter Armand le Comte de Fontainemoreau, Paris, London, and Brussels—Improvements in marine or condensing steam engines. (A communication.)

Dated 10th December, 1857.

3050. Richard Reeves Cox, Kentish town—Improvements in the manufacture of fire lighters, and in apparatus or stoves for burning the same.

Dated 11th December, 1857.

3056. John Gedge, 4, Wellington-street South, Strand—Improvements in the process of rectifying liquids, and in the apparatus used therewith. (A communication.)

Dated 16th December, 1857.

3086. John Francis Seeley, Everett-street, Brunswick-square—An improved machine or apparatus for cutting out materials used in the manufacture of boots, shoes, and other coverings for the feet.
3090. Matthew Semple, Stonehouse, Devon—Improvements in preserving meat, fruit, vegetables, and other edible substances and fluids.
3092. Henry Gregory, Manchester—Certain improvements in machinery or apparatus for making "lozenges," or other similar articles.
3094. Dr. James Joseph Cregeen, Plough-road, Rotherhithe—Improvements in the treatment of India and China grass, pine apple, hemp, flax, and other similar fibrous materials, and in the machinery or apparatus employed therein.

Dated 17th December, 1857.

3098. John James Davis, Percival-street, Clerkenwell—Improvements in presses for printing or endorsing and embossing.
3102. Henry Johnson, Crutched-friars—Improvements in apparatus for drawing geometric curves.
3104. William Woofe, Tetbury, Gloucestershire—Improvements in ploughs.
3106. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in machinery or apparatus for hulling cotton and other oleaginous seeds, applicable also to the hulling of cereals. (A communication.)

Dated 18th December, 1857.

3108. John Horace Taylor and Robert Tate Barrett, Victoria Dock-road, Essex—Improvements in apparatus for the prevention of smoke, and for effecting a better consumption of fuel in steam-boiler furnaces.
3110. Thomas Coxon Wilkinson, Ashford, Kent—Improvements in pump valves.

INVENTION WITH COMPLETE SPECIFICATION FILED.

3175. James Cottrill, Studley, Warwick—Improvements in the manufacture of certain descriptions of needles.

WEEKLY LIST OF PATENTS SEALED.

January 1st.

871. John James Russell.
1834. Carl Johann Lawrence Leffler.
1835. William Edward Newton.
1839. Edouard Beckman Olofson.
1846. George Davies.
1848. Tomyns Browne.
1852. Jean Baptiste Meeus.
1859. Henry D. Mears and William Houlton.
1861. William Thoms Hendry and Robert H. Hancock.
1863. Thomas Royds, Thos. Roscow, and James Lord.
1867. George Cooper.
1870. John Smith.
1883. Peter Hippolyte Gustave Bérard.
1884. Peter Hippolyte Gustave Bérard.
1886. William Smith.
1888. Rd. Archibald Brooman.
1891. Michael Henry.
1896. Jules Joseph Henri Brianchon.
1914. Thomas Lewis, Henry Parrish, and Robert Martin Roberts.
1933. Datus Ensign Rugg.
1938. Hippolyte Lamy.
1946. William Edward Newton.
1947. William Edward Newton.
1950. Samuel Nye.
1969. John Henry Johnson.
1970. Henry Blandford.
1971. John Henry Johnson.
1994. William Edward Newton.
1997. George John Newbery.
2003. William Edward Newton.
2021. M. Clark and G. Bertram.
2056. Robert Jackson.
2270. John Henry Christian Lobnitz and James McLintock Henderson.
2377. Isidore Charles Cloet.
2323. Adrien Jules Alexis Dumoulin.
2401. Alphonse René Le Mire de Normandy. and Edward Thornhill Simpson.
2503. John Charles Pearce.
2561. Conrad William Finzel and James Bryant.

January 5th.

1874. Charles Faulkner and David Faulkner.
1889. William Burgess.
1894. George Green.
1897. Joseph Gibbs.
1906. John Holley Swan.
1908. John Julius Cléro de Clerville.
1912. William Mann.
1919. Isac Louis Pulvermacher.
1921. Sir Frs. Charles Knowles.
1922. Rd. Archibald Brooman.
1931. Edouard Primard.
1932. William John Thos. Smith and Frederick Talbot.
1981. Joseph Russell, Henry Wm. Spratt, and Wm. Press.
1992. George James Wainwright and Chas. Timothy Bradbury.
1998. Frederick Hall Holmes.
2016. Alfred Vincent Newton.
2090. John Beale.
2531. Peter Kerr.
2853. James Stevenson, jun.

Patents on which the Stamp Duty of £50 has been Paid.

December 28th.

2761. Thomas Slater and Joseph Tall.

December 29th.

2759. George Edward Dering.
2760. Robert Sam North.

January 1st.

25. George Walker Muir.

January 2nd.

10. Claude Jules Fincken.
21. Alexander S. Stocker and Samuel Darling.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4040	Jan. 4.	Expanding Bar for Chain Harrows	John Cartwright	Shrewsbury.
4041	,, 5.	A Paper File	John Faulkner	62, St. Martin's-le-Grand.
4042	,, 6.	Salmons' Calosynthetic Stereoscope	Wm. John Salmons	100, Fenchurch-street.

Journal of the Society of Arts.

FRIDAY, JANUARY 15, 1858.

EXAMINATIONS.—NOTICE TO INSTITUTIONS.

No person who shall not have been for three months previously a member of, or student of a class in, an Institution in union with this Society, can be admitted to the Final Examinations. Moreover, to bring the Examinations within reach of the Members of *Incipient* Institutes and small Evening Classes for Adult Instruction, which cannot afford to pay two guineas for union with the Society of Arts, any Provincial Union or Association, or Local Board for the promotion of Adult Instruction, may unite with itself any number of such incipient Institutions and Small Evening Classes in its district, and give to the whole of them, but *not to fully developed Institutes*, the privileges of Union with the Society of Arts in respect of the Examinations, for a single annual payment of Two Guineas.

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The Committee are very desirous of obtaining instances of fraudulent or wrongful acts relating to works of Fine Art. Members and others in possession of such facts are requested to communicate with the Secretary of the Society of Arts.

CONFERENCE—EXAMINATIONS.

A Conference between the Council of the Society of Arts and the Representatives from the Institutions in London and its neighbourhood, was held on Monday, the 11th inst., at six o'clock. The chair was taken by C. Wentworth Dilke, Esq., V.P., and Chairman of the Council, who opened the meeting by explaining the object of the Council in convening it, and called upon

Mr. Harry Chester, V.P., who said that, however successful the Examinations hitherto conducted by the Society had been, as far as they went, yet it must be obvious, looking at the Institutions scattered as they were over all parts of the kingdom, that the system hitherto adopted did not give to their members the facilities for examination they had a right to expect. Last June there were two centres of Examination, one in London and one in Huddersfield. The result showed that only 37 Institutions availed themselves of them. Hence, the determination of the Council to adopt the present scheme, as detailed in the Programme which had been circulated to all the Institutions in the Union. The Council desired to throw some portion of the management of the Examinations upon the Institutions, feeling assured that it was greatly for the advancement of the Institutions themselves, that the Society should not do for them that which they could well do for themselves. Mr. Chester then pointed out the nature and duties of the Local Boards in connection with the scheme, as detailed in the Society's Programme, and stated that the Northern Union of Mechanics' Institutions, embracing the four northern counties, the Yorkshire Union of Mechanics' Institutes, the Institutional Association of Lancashire and Cheshire, the Hants and Wilts Adult Education Society, and the Bucks and Berks Association, were already possessed of an organisation, which was being brought into operation for forming Local Boards to co-operate with the Society. At Sheffield the Mayor had convened a meeting of Representatives of the Institutions in that town, and a joint committee had there been formed to carry out the Society's Programme. At Brighton a meeting was about to be held for the same purpose, and the Council were in communication with many other towns where the like proceedings were taking place. The present meeting was called to facilitate similar arrangements in the London districts. He suggested that it would be convenient that several Institutions in a district should form a joint Board. This Board need not be numerous. The duties it must *necessarily* discharge under the programme were very simple, though doubtless others, of great importance to the improvement of education, might well be discharged by such a Board when once formed. The necessary work would be—1st, To test the Candidates in the elementary subjects, and to ascertain whether they were likely to pass in the special subjects comprised in the papers to be sent by the Society's Board. 2nd. To superintend the working of the Society's papers by those candidates who had previously passed the Local Board, and to certify that the work had been done without copying, or the assistance of books, &c. Under these arrangements, it would be seen that the Candidates passed by the Local Board, would not have to leave their localities to be examined by the Society's Board; the papers would be sent down by that Board to be worked in their several localities. For these necessary purposes the Local Board need not be numerous; in fact, two or three gentlemen possessing the confidence of the Institutions could do the work. The committee of the Crosby-hall Evening Classes had already formed a Local Board, and were ready to admit to it the members of such Institutions as were disposed to join them, upon certain terms. The Polytechnic Institution was also ready to form a Local Board, and to admit such Institutions as thought it desirable to join that body.

A conversation then ensued, in which Messrs. Smurthwaite, Edwards, Chester, Rev. C. Mackenzie, Winkworth, Sir Thos. Phillips, Hamilton, Andrews, Rev. W. Bashall, Pearsall, Buckmaster, Rev. R. Whittington, Rev. W. Hodgson, and others took part, when it was moved by the Rev. Charles Mackenzie, and seconded by Mr. Edwards, and resolved *nem con.*

"That the Council invite the Secretaries of the various Institutions in London, in union with the Society of Arts, to meet at the Society's house, for the purpose of suggesting convenient places in which Local Boards may be formed."

A vote of thanks to the Chairman having been passed, the meeting separated.

SIXTH ORDINARY MEETING.

Wednesday, Jan. 13, 1857.

The Sixth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 13th inst., Thomas Sopwith, Esq., M.A., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Ames, Edward Levi, M.A. | Macadam, Charles Thos.
Odams, James.

The following Institution has been taken into Union since the last announcement:—

450. Sheffield Church of England Educational Institute.

The Paper read was:

ON THE ADVANTAGES OF A DAILY REGISTER OF THE RAINFALL THROUGHOUT THE UNITED KINGDOM, AND THE BEST MEANS OF OBTAINING IT.

By J. Bailey Denton, F.G.S., Assoc. Inst., C.E., Engineer to the General Land Drainage and Improvement Company.

It has often been said that Englishmen begin their best works at the wrong end, and acquire by dearly-bought experience the elementary knowledge upon which they should have started. There are few subjects to which this imputation is more justly applicable than the disregard of Rainfall in relation to many of the greatest agricultural, sanitary, and domestic improvements which have long taken a leading place in our attention. It may be fairly said that, within the last 20 years, we have heard more about the want of under-draining of land, the growing necessity for improved arterial drainage, the advantages of irrigation, the utilisation of water in rural and domestic economy, the defective sewerage of towns, and the waste of millions in the refuse, than perhaps we ever heard before; and though each may be said to involve a question of demand or supply, and neither drainage nor sewerage for the removal of surface water and town refuse can be conducted without providing for the maximum rainfall, nor any profitable application of water can be made without regard to the minimum, we are content to remain to this hour in comparative ignorance of the first great element—Quantity,—and to work out our problems without the principal datum.

This want of information is not owing to the absence of societies and commissions qualified to organise the means of obtaining it, for we have existing at the present moment the chartered Agricultural Societies, the Drainage Commissions, the Central Board of Health, and the survey department of the Ordnance—institutions all founded for objects which cannot be fully and properly attained so long as we remain in our present ignorance.

Does this apathy or inattention proceed from a disbelief that the information would be of sufficient practical value to warrant the necessary outlay to obtain it? It can hardly be so. In the returns of the Registrar-General, we find a recognition of the importance of the subject in the reports of upwards of 50 correspondents on the rainfall and other meteorological phenomena, upon which deductions are based, bearing upon the health and mortality of the country; and I think all persons must agree with Mr. Glaisher, that "there is scarcely an element in meteorology more important, or involving more beneficial interests to mankind, than a knowledge of the actual fall of rain," and that "it is desirable to know the kind of diseases peculiar to rainy districts," and "whether wet periods of the year exercise any appreciable influence on the growth and progress of disease." Every agricultural observer can furnish evidence of the important effect of excess and scarcity of water in the health and increase of domestic animals, and on the development of the vegetable productions of the country,* and this being so, there can be no doubt as to the value of a perfect knowledge of the quantity of rain at our disposal.

My object is to show how little we do know on the subject, and how unavailable that little is.

It was only in 1816, that the able author of "The Climate of Britain" (Williams), alleged that the climate of these islands was deteriorating in consequence of the increase of evaporating surface. Now the general belief is that the climate of these islands is improving, and the fall of rain becoming annually less, but we have no data to confirm the belief. It is not based on any meteorological records, but on the fact that the extent of woodland throughout the country is decreasing, the thick and numerous hedgerows (which were multiplied after the enclosure of the open lands, and which led Williams to think the climate deteriorating,) are giving place to the narrow, straight, and comparatively few fences which characterise good husbandry—our fens have been converted from inland lakes and rushy swamps, into highly productive arable lands, and drainage generally is extending; the imperfect and temporary practice of shallow drainage being abandoned in favour of permanent deep drainage. By all these acts of improved cultivation, we may safely presume evaporation is considerably diminished; and, the humidity of the country being much more dependent upon the extent of evaporation than on the quantity of rainfall, we may fairly assume the climate improved.* Beyond this, too, if when lessening evaporation by clearing the surface of woodland and by draining the soil, we reduce the rainfall—which would seem to be a natural consequence, were it not that the sea is so near at hand to replenish the atmosphere—another and equally potent reason is found for the assumed improvement.

The returns of the Registrar-General and the journals of the meteorological societies, are the nearest approaches to systematic records which have yet been attempted, but they include only the voluntary contributions of a comparatively few individuals, and from that circumstance and from the fact that they are necessarily distant and isolated, no practical utility results from their publication, beyond the interest they maintain on meteorological subjects among scientific men. Our scientific teachers and meteorological authorities, are still necessarily compelled to deal with the "mean" and "average" quantities of these and like returns, which in these sea-girt lands, so differently affected on different sides, with conditions of surface so various in elevation and geological structure, is a practice unworthy of the age in which we live, and wholly irreconcilable with the advanced and useful objects at which we aim.

And if this be so as to the quantity of rain that falls on the surface, the contradictory opinions and deductions which have been published and still prevail, as to the quantity of moisture evaporated from the surface are equally striking.

Mr. Daniel showed that "the amount of evaporation ($23\frac{1}{16}$ inches) very nearly equalled the quantity of rain (23·974) that fell in the vicinity of London."

Dalton says:—"Evaporation from land in general must be less than the rain that falls, otherwise there would be no rivers."

Professor Leslie found that evaporation was daily, in summer ·048, and in winter ·018.

Dr. Dobson, of Liverpool, showed that the evaporation from the ocean was 36·78;—and Mr. Charnock showed by his experiments that evaporation was much greater from saturated soil than from water. (See *Journal of Royal Agricultural Society*.)

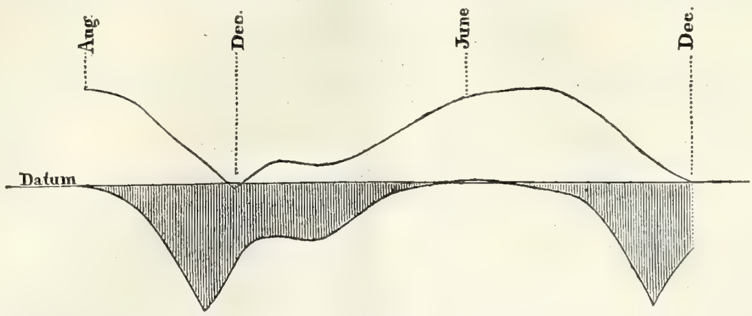
Dr. Hugh Colquhoun, of Glasgow, showed that evaporation took 14 inches out of 26 inches rainfall.

The Central Board of Health assumed in their Report of 1850, that the quantity of moisture evaporated from the surface or absorbed by vegetation was "almost constant," viz., from 15 to 20 inches.

Mr. Dickinson, the paper-maker, showed by a guage buried in an open stratum three feet deep, that 57.6 per cent. did not penetrate to that depth, and therefore was evaporated or absorbed by vegetation, and that the remainder (42·4) passed into the guage. This record has a peculiar interest, because it was upon its truth that Mr. Dickinson based his contracts for the making and supply of paper. The tabular statement published by his authority I have reduced to a section, in order to show distinctly the proportion which was lost, and that which became useful to the observant Mr. Dickinson.

* See the admirable articles of Mr. Whitley, in the *Journal R. Agri. Soc.*, and of Mr. Russell, in the *Cyclo. of Agriculture.*

* It was Arthur Young who stated that the humidity was "better marked by the hygrometer than the rain-guage." This was said 80 years back. Have we advanced much in practical deductions since?



EXPLANATION.—The datum line separates the water that percolated into the lower regions of the earth, and supplied the rivers upon which Mr. Dickinson's mills were situated, from that which re ascended by evaporation, or was appropriated by vegetation, and therefore lost to Mr. Dickinson.

The experiments made by me at Hinxworth (see Appendix), from 1st October, 1856 to 31st May, 1857, *i.e.*, from the time the drainage executed there began to discharge water to the time the drains ceased to run, show that the quantity of rain which percolated the soil, and was discharged by the under-drains, was very much greater in the open (water-bearing) strata than in the clay soils. I found that although the clays discharged a larger proportion of heavy downfalls within the first 24 hours than the open soils, the latter actually discharged in the aggregate nearly seven-tenths of the rain that fell in the eight months, while the former did not disgorge much more than one-fourth of the rain that fell upon them, although no portion was seen to pass off the surface. The well-known retentive property of clays is clearly exhibited by this remarkable difference; and if the quantity of water discharged by the drains can be taken *as indicative of the quantity of evaporation prevented or diminished*, the difference would appear to destroy the assumption of the Board of Health (1850), that evaporation "is constant."*

Such are the conflicting opinions as to evaporation, but I do not propose to go further into the wide, though very important, topics of climate and its influence on animal and vegetable life, but to confine myself to those practical questions connected with engineering, with which I feel myself better qualified to deal.

It has been in the furtherance of the very important works of agricultural drainage and town sewerage that several millions of public money, and borrowed money to be repaid by local rent-charges, have been expended. The Inclosure and Drainage Commissions have governed the expenditure in the one case, and the Health of Towns Commission that in the other. For eleven years and more, public money has been expended, in the first instance in Ireland, and subsequently in England and Scotland, without any effort to supply the desideratum, which I hope to show is so manifestly essential to economy and efficacy in all works designed for the removal or utilisation of surface water.

I have tabulated all the returns I could collect of an authoritative kind, with the kind assistance of Mr. White, of Camberwell, and they are given in the following schedule. To render the amount of information we possess as clear as possible, and to show how little that information is, I have marked the site of each station on a map of the British Isles, over which lines are ruled, latitudinally and longitudinally, at intervals of ten miles, so that the eye may judge, comparatively, of the wide spaces upon which no records have been kept. Each square encloses 100 square miles.

* The conservative character of clay soils is well expressed in the following old distich:—

"When the clay shall feed the sand,
Then it's good for old England;
But when the sand feeds the clay,
Then she cries, 'Oh! lack-a-day.'"

TABLE OF RAINFALL, SHEWING THE STATIONS IN THE BRITISH ISLES RECOGNISED AS DULY AUTHORITATIVE.

Latitude.	Name of Station.	Rainfall.	Authority or Observer.
Deg. Min.	ENGLAND.		
50 05	Helston	36·80	Registrar-General.
50 07	Penzance	44·70	*Philosophical Magazine*, Whitley.
50 10	Falmouth	43·7	Royal Institution of Cornwall.
50 14	Truro	33·53	Registrar-General, Whitley, and Allnutt.
50 30	Teignmouth		Registrar-General.
50 30	Tavistock	53·6	Whitley.
50 30	Goodamoor / Dartmoor	57·5	Whitley.
50 41	Little Bridy	38·70	Mr. Eaton, M.B.M.S.; Registrar-General.
50 42	Exeter	32·58	Royal Institution of Cornwall, Whitley, Allnutt.
50 45	Gosport	31·07	Simmonds. (Burney, 29.5)
50 47	Worthing		Registrar-General.
50 52	Hastings	28·00	Milner.
50 54	Southampton	29·83	Lieut.-Colonel James (two years), Allnutt.
50 58	Uckfield	28·70	Allnutt.
51 16	Cobham	25·46	Royal Institution.
51 16	Maidstone	21·29	Mr. Fielding (two years), Allnutt.
51 27	Bristol	29·2	Prout, Whitley. (Allnutt, 30·12)
———	Clifton (near)		Registrar-General.
51 29	Chiswick	24·8	Howard.
51 28	Lewisham		Mr. Glaisher.

TABLE OF RAINFALL (Continued.)

Latitude. Deg. Min.	Name of Station.	Rainfall.	Authority or Observer.
51 29	Greenwich	21·37	Royal Observatory.
——	London	22·2	Daniel.
51 30	Camberwell	24·65	Mr. W. H. White, late Secretary to the Meteorological Society.
51 33	Upminster	19·50	*Penny Cyclopædia.*
51 36	Swansea	36 60	Jenkins, Whitley.
51 39	Enfield	22·50	Mr. Heath (four years), Registrar-General.
51 40	Epping	26·39	Royal Institution.
51 43	Stroud		*Cyclopædia of Agriculture.*
51 45	Hartwell		Registrar-General.
51 47	Aylesbury	21·00	Milner.
51 45	Great Berkhampstead	29·14	Mr. Squire, M.B.M.S.; Registrar General.
51 46	Oxford	24 06 27·74 22 00	Allnutt. Mr. Johnson, Registrar-General. Milner.
51 50	Gloucester		Registrar-General.
51 50	Monmouth	30·00	
51 54	Cheltenham	25·25	Mr. Moss.
51 54	Bicester		Registrar-General.
52 03	Royston	26·00	Mr. Wortham, M.B.M.S.
52 04	Hereford		
52 07	Cardington		Registrar-General.
52 08	Lampeter	36·69	Rev. S. Matthews, M.A. (Allnutt.)
52 08	Bedford	27·	Milner.
52 12	Worcester	26·35	(?) (Two years only) Allnutt, Registrar-General.
52 13	Cambridge	20 00	Milner.
52 17	Thwaite	23 27	*Cyclopædia of Agriculture.*
52 25	Thetford	19·00	Milner.
52 37	Norwich	22·55	(?) Whitley, 25·5.
52 54	Grantham, Belvoir Castle	24·03	Registrar General, Mr. Ingram (3 years).
52 56	Nottingham	25·08	Mr. Lowe, Registrar-General.
52 57	Holkham	27·44	Mr. Shillabear, Registrar-General.
52 58	Derby	27·	Milner, Registrar-General.
53 00	Boston	24·90	*Philosophical Magazine*, Whitley.
53 10	Hawarden	23·42	Allnutt (two years), Registrar-General.
53 20	Knutsford	23·36	*Philosophical Magazine.*
53 25	Liverpool	36·18	(?) Natural History Society (4 years)—(*Journal of Science*, 34·1.) Registrar-General.
53 29	Manchester	36·14	*Farmers' Encyclopædia.*
53 29	Marple	36·56	It is believed that the staff-guage may have been used for ascertaining the fall in these places; and the staff-guage is not to be relied upon.
53 29	Chapel-le-frith	42·98	
53 30	Bolton	46·74	
53 31	Bury	41·72	
53 31	Rochdale	46·75	
53 31	Blackstone Edge	36·29	
53 31	Fairfield	34·84	
53 39	Ackworth	26·	*Philosophical Magazine.*
53 42	Wakefield		Registrar-General.
53 45	Leeds	20·04	Mr. Denny (four years), Registrar-General.
53 58	York		Registrar-General.
54 17	Scarboro'	22·89	Registrar-General, Mr. Barrington Cooke.
54 21	Kendal	58·00	*Journal of Science.*
54 25	Seathwaite	146·40	Royal Society.
54 30	Gatesgarth	121·40	Royal Society.
54 33	Keswick	63·60	Royal Society.
54 33	Whitehaven	47·10	Royal Society.
54 37	Cockermouth	48·50	Royal Society.
54 46	Durham	30·56	Registrar-General.
54 53	Carlisle	30·55	Simmonds.
55 01	North Shields	25 00	Milner, Registrar-General.
——	Bywell		Registrar-General.
	IRELAND.		
51 55	Cork	36·03	Royal Institution. (40·20, another observer.)
52 29	Limerick	35·00	Mr. Peterman.
52 35	Toomevara	40·50	Whitley.
53 10	Portarlington	27·15	Dr. Hemlow (two years only)
53 20	Dublin	24·60	Trinity College.
53 42	Edgeworth-town		Transactions of Irish Academy, Whitley.
54 10	Coloony	42·00	Whitley.

TABLE OF RAINFALL (Continued).

Latitude.	Name of Station.	Rainfall.	Authority or Observer.
Deg. Min.			
54 21	Armagh	25·26	Dr. Robinson (two years).
54 36	Belfast	27·49	Queen's College. (30 to 39½, say Belfast Society for Promoting Knowledge)
55 00	Londonderry	———	Transactions of Irish Academy.
	SCOTLAND.		
55 13	Applegarth Manse	33·60	*Philosophical Magazine.*
55 34	Makerstun	24·32	Mr. Hogg (two years only).
55 50	Glasgow	30·00	McCulloch, Whitley.
	Carbeth	42·50	Ditto.
55 51	Rothesay	38·50	*Cyclopœdia of Agriculture.*
———	Mount Steward	46·60	Whitley.
55 54	Annatt		
55 55	Dalkeith	22·00	McCulloch.
55 57	Greenock	40·00	Milner.
55 58	Dunoon	56·00	Ditto.
55 58	Edinburgh	24·00	Professor Johnson, Simmonds.
56 00	Peebles	28·70	Milner, McCulloch.
56 04	Lochiel's Head	37·00	Mr. Malcolm (two years.
56 10	Kinfauns Castle	25·60	140 feet above sea.—Whitley.
———	Hill near	41·50	600 feet above sea.—Whitley.
56 29	Dundee	22·00	McCulloch.
57 09	Aberdeen	23·30	Simmonds.
57 16	Clunie	25·00	Milner.
57 18	Alford	37·90	*Edinburgh Philosophical Journal.*
57 28	Inverness	26·00	Milner.
	ISLANDS.		
49 12	Jersey		
49 33	Guernsey		Registrar-General.
	Ventnor ...		Registrar-General.
50 42	Newport... } Isle of Wight...	29·80	Mr. Bloxam (two years).
	Ryde		Registrar-General.
54 10	Isle of Man	36·25	*Journal of Science.*
58 12	Lewis	30·06	Sir James Matheson, Bart. (two years).
59 00	Orkney	36·83	*Philosophical Magazine.*

Note.—These Stations have been selected as those which are deservedly authoritative. They have been selected from standard publications only. Most interesting and valuable information is given in the reports of Mr. Homersham as to the relative effect of *height of station*, using the same guage, with precisely the same treatment in every other respect.

Although the agriculturist, the engineer, and the physician will be unable to apply practically the information this schedule gives, the curious in matters of science will be struck with the following facts:—1st. That the rainfall in one district is more than seven times that of another; 2nd. That the difference of rainfall at one point, compared with another, is as much as 127 inches; 3rd. That the rainfall on the western side of England ranges from 30 to 51 inches, while that on the south-eastern side ranges from 16 to 24 inches; hence the "mean" of the one is double that of the other [*See also McCulloch*]; 4th. That the rainfall on the western extreme (Penzance) is 44·70, while that on the eastern (Thwaite, in Suffolk) is 23·27; 5th. That comparing places, of the same degree of latitude, the rainfall at Manchester (lat. 53 deg., 27 min.) is 36·14; at Nottingham (lat. 52 deg., 57 min.), 25·08; and at Boston (lat. 53 deg.), 24·90; 6th. That the rainfall in the Isle of Man (lat. 54 deg., 15 min.) is 36·25; at Kendal (lat. 54 deg. 21 min.) is 58 inches, and at Scarboro' (lat. 54 deg. 17 min.) 22·89; 7th. That comparing places on the same geological formation, *i.e.*, with soils very possibly the same mechanically and chemically, the following differences will appear. Take the old red sandstone, which is found in South Devon, in Monmouthshire, and Buteshire in Scotland; the rainfall at Dartmoor (Goodamoor) is 57½ inches; at Monmouth 30 inches; and at Mount Stewart 46½. On the lias, with its close clay,—which crops out in Dorsetshire, and extends to the north of Yorkshire, taking Grantham in its course—the rainfall at Little Bridy is 38·70; at Grantham 24 inches; and at Scarboro' 22·89. Or if we come nearer home, on to the outskirts of the London basin, we find, at Cambridge and Thetford, the rainfall is less than 20 inches; at Gosport and Hastings nearly 29 inches; and in London, midway between the escarpments, it is 22·2 (Daniel).

Having shown, as far as I am able, the amount of information which at present stands on record, it remains to be exhibited how a perfect system of registration might be made available in the hands of the engineer for a better mode of under drainage, improved means of arterial drainage, and the profitable application of drainage and surface waters.

1. *Under Drainage and Sewerage.*—As the removal of surplus surface water is the primary object of agricultural drainage, and as the rain falling on the surface of town districts is the main obstacle with which engineers have to contend in designing the sewerage of towns, it can hardly be necessary to show that the very first question to be solved should be the amount of rainfall peculiar to each locality.

This assertion in respect to the under-draining of land has been always met by the statement that the drains used are so numerous in the aggregate, and so much more capacious than can be required under any circumstances, that it is an unnecessary refinement in the application of science to inquire into the quantity of rain

the pipes are to carry, or to burden the proceedings by calculations of their dimensions. I am bound, however, to record my own conviction, based on an extensive practice in the drainage of land, that there is no information more essential to successful treatment than that which it is the object of this paper to promote, and that it is the ignorance now prevailing with regard to the influence of the rainfall, added to the common belief that drainage is a mechanical operation which an uneducated bailiff or woodman may carry out, that has led to the discredit attached to the drainage executed under government auspices, and has fostered the opposition of certain members of the Central Farmers' Club. As a proof of how little attention landowners have hitherto paid to rainfall, I may mention that when I undertook to read a paper, three years back, before the Central Farmers' Club, on the results of under draining in Great Britain, I addressed more than 300 persons in various parts of Great Britain, who had executed works of under draining, and asked the following question among several others,—"What is the rainfall in the locality of your works?" I was gratified by receiving 162 answers to my letters, but out of 162 answers there were only six who were able to give me any information as to the rainfall.

No doubt this prevailing inattention has arisen from, and the arguments used against the utility of a knowledge of rainfall have been supported by, the fact that when we aim at draining tenacious clay lands, we can only fully attain the object by a multitude of conduits, which serve not only to remove the maximum quantity of water reaching them, but to aërate the soil whereby their natural retentiveness (which is three times as great as sandy soils) is overcome and percolation facilitated.

In the drainage of open soils, *i.e.*, the water bearing strata, which alternate with the retentive and so-called non-porous strata from one end of the kingdom to the other, there is no such two-fold object by which to excuse an excess of outlay; and the quantity of water to be removed is the measure of the size of pipes, the number of the drains, and the mode of draining to be adopted. Every drain in excess of what will effect this single purpose is positive waste, whereas in clay soils, uniform aëration and disintegration being points of equal importance with the removal of surplus water itself it is hardly possible to increase the number of drains without producing some benefit. To relieve the open water-bearing strata of the excess of water which presses from the higher to the lower levels, three inquiries are essential to economy and success. 1. The quantity of rain falling in the district. 2. The extent and altitude of the contributing area, and 3. The nature and position of the impounding substratum. To show how much at fault we are at this moment in our treatment of the open soils of different formation, which, for the most part, would be equally susceptible of percolation if channels of discharge were provided below, it may be mentioned, that the silicious beds of the crag in Suffolk, where the rainfall does not reach 20 inches, are being drained in a very similar manner to the valleys composed of drift and debris of the primary and transition rocks in Westmoreland and Cumberland, where the rainfall is 50 inches, and where a maximum fall has been recorded of 31 inches in a single month, equal, in fact, to 18 months' rain in Suffolk. (*See Miller, on the New Philosophical Journal of Edinburgh*, 1853.)

In acknowledging that in clay soils the number of drains usually adopted for thorough drainage are at all times sufficient, when properly connected with full-sized main drains, to carry off any possible fall of rain, it should be understood that in order to produce that perfect amelioration to which I have referred, the number of drains should be multiplied beyond the quantity required for removal of water in proportion to the quantity of rain falling upon the surface and the prevalence of humidity. To appreciate this position, it should be remembered that Sir Humphrey Davy showed that stiff clays will absorb from the atmosphere alone 1-30th of their own weight in a single night. With absorption comes expansion, and to such extent that the difference in size between the same clays, wet and dry, will sometimes reach one-fifth (Johnstone). Hence, resistance and their incapacity to admit water to pass through them as rapidly as other soils.

Having stated that it is the omission of such considerations as these, and the provisions which the difference in rainfall should suggest that has led to dissatisfaction and encouraged opposition to permanent works of drainage, I am bound to give evidence of the fact. In the west of England, where the annual fall of rain is 50 inches, some drainage was effected by a parallel system 40 feet apart. It was pronounced a failure. It has been compared with other works of drainage which were satisfactory in result upon the same geological formation (with soils closely similar in character), drained in the same way, on the east side of Scotland. The rainfall there was 25 inches, and the number of wet days considerably less than in the West of England, and it is more than probable that these differences account for the results. Another instance will render the proposition even more clear. The lias clay, as already stated, runs nearly the whole length of England. It starts from Lyme Regis, where the fall of rain is 37 inches, passes by Grantham, where the fall is 24 inches, and runs out at the north-east corner of Yorkshire, where the fall is 21 inches. Lands of this clay (as similar as soils can be) have been drained in the several localities in a precisely similar manner with different degrees of effect. The difference in the rainfall can alone explain the difference of effect. Sixteen inches of rain, which is the difference between the two extremes, is equal to 362,000 gallons falling upon every acre of land, and this excess is nearly equal to the whole annual amount of rain falling on the surface of Essex and Suffolk, in which counties many thousands of acres of clay lands, no stronger than the lias, are now being drained at a cost of from £5 to £6 per acre. This is a striking fact, but it will be rendered still more striking by reference to the Registrar-General's Return for the first three months of the year just closed. There it will be seen that the rainfall, for that period at the three places named, was respectively 9 inches (Little Bridy), 6 inches (Grantham), and three inches (Scarborough). Hence it follows that the drains in Dorset would be required to do three times the work of drains in Yorkshire with the same means of doing it.

Time will not allow of my multiplying instances in which a knowledge of the rainfall would lead to a more profitable and satisfactory treatment of under drainage. With clay equally tenacious, but affected differently by the amount of rain falling upon their surface, it would not be difficult to expose, by a multiplicity of facts, the inconsistency of which we are daily guilty, and the many causes we have given for failure.

And if we turn from land drainage to town sewerage, we discover the same want of information and similar evils resulting from ignorance. To dispose of the rain-water falling on the surface of town districts, without increasing the cost of the sewerage works beyond reasonable limits, is often the problem which defeats progress, and as we have frequently no reliable records of the quantity of rain falling on the surface, the difficulty of solving it is increased. It is so with respect to the metropolis at the present moment, and the metropolis is only a magnified type of all other towns in respect to the principles which should govern works of sewerage.

2. I will now pass to *Arterial Drainage*. It cannot be many years ere this important branch of engineering forces itself on public attention, for reasons which have a direct bearing on the subject of this paper. The circumstances to which I refer, are, 1st, the growing spirit of improvement which will shortly demand the underdraining of the valley lands, now incapable of being

drained at an adequate depth for want of effective outfall; 2ndly, the incapacity of numerous rivers and streams to receive and discharge the increasing quantity of water thrown into them by the underdrainage of the water-bearing strata and beds; and, 3rdly, the sudden discharge of water from the underdrains of clay lands immediately after heavy falls of rain.

The test of all underdrainage is the depth of free soil through which water will pass to the drains. In an open soil, a few drains will suffice to keep down the level of standing water as effectually as the numerous drains of the clays. But the amount by which evaporation is diminished by drainage must be very different in the two descriptions of land. In the open water-bearing soils, the amount of evaporation must be greatly diminished by underdrainage; in the clays it would appear to be very little affected. Under any circumstances, it may be assumed that whatever the amount of water arrested from the atmosphere by underdraining, that quantity is discharged to the sea by the main and tributary outfalls in excess of what was discharged previously.

At Hinxworth, (see Appendix) the occasional drains by which the open mixed soils (see Mr. Way's analysis in Appendix) were relieved of excessive wetness were frequently 75 yards asunder, and from 4 to 7 feet deep. Before draining the open soils, the subterranean water level, following the universal law, gradually rose to the surface as it was replenished by the winter's rains, corroborative of the old Wiltshire saying, "As the days lengthen so the springs strengthen." The water that so rose to the surface found escape by excessive evaporation in the months of March, April, and May, and by oozing from the lowest grounds in the nature of springs, which declined in height as the summer advanced, and as the subterranean water level declined. After draining, the quantity of water discharged by the underdrains from these open soils during the period they were running, was 160,920 gallons per acre, out of 227,240 gallons which the rain guage showed fell upon every acre of surface, and it is fair to assume that the greater part, if not the whole, of this large quantity of water was that which would have been dissipated by evaporation if the land had not been drained (See Johnstone's Elements of Agricultural Chemistry, pp. 124, 125), for it does not appear that the supply to the rivers has been in any way affected in the summer season. These open lands were discharging, throughout the greater part of January and February, when evaporation is very trifling, above 1000 gallons per acre per diem of that water which would have remained in the soil until the east winds of early spring and the influence of the sun in May and June had converted it into vapour at the expense of vegetation. When this quantity is multiplied by the number of acres of similar land drained and to be drained in these islands, the quantity of *new* water which has to find its way into the outfall streams will be appreciated.

Referring again to the Hinxworth records, we find a very different result with respect to the clay lands, which were drained uniformly 4 feet deep, 25 feet apart (see Mr. Way's analysis). The quantity discharged by the numerous underdrains while they were running, was 59,936 gallons per acre, leaving 167,384 gallons in the soil to be lost by evaporation and appropriated by vegetation. Before draining these clay lands, that portion which the soil could not absorb either flowed off the surface to the outfalls, or remained on it to be evaporated. After draining, the rain-fall penetrated to the depth of the drains, and when once the Autumn rains had completely replenished the absorbent demands of the soil, and the two powers of gravitation and attraction had struck a balance, a large proportion of any succeeding rain was immediately discharged by the underdrains. There was a fall of rain at Hinxworth in October, 1856, of 1·645, and in November of 1·630, equal together to a supply to the soil of 74,087 gallons, or 330 tons of water per acre. The drains just began to trickle on the 27th of November, after a fall of half an inch of rain (·540). The test holes in the land showed that the soil was rapidly feeding itself and that the water level was rising, but had not reached the level of the drains. On the 12th December, the outlets were running 160 gallons per diem per acre after frequent rains in the early part of the month of less than a tenth of an inch per diem. On the 13th, the rain guage showed a fall of ·452 (nearly half an inch) and the outlets increased their discharge from 160 gallons to 975 gallons per diem per acre. On the 9th January, 1857, the outlets were running 125 gallons per diem. On the 10th, the rain guage showed a fall of ·542 (rather more than half an inch), and the discharge from the outlets was increased from 125 gallons to 5,150 gallons per diem per acre. How important are these facts in considering the effect of extended underdrainage on the arterial channels of the country, and how necessary a knowledge of the rainfall in providing for it. The Hinxworth records show that the clay lands which prejudice had declared impenetrable, were discharging after heavy rains in the wet season a greater quantity of water per acre than the open soils, and much more than it is believed would have flowed off the surface before the land was drained.

Before quitting the subject of arterial drainage, there appears to be one other point upon which an accurate knowledge of the amount of rainfall would be of signal service. It is admitted on all hands, that no general improvement of outfalls can take place, without a sacrifice of numerous mills and the water power by which they are worked. If a sacrifice such as this is necessary to obtain a national benefit, is it not our duty to look around and see if there be not within our reach a compensatory amount of power at higher points, which may be made available for use by drainage and conservation.

I do not wish to detract from the attention I hope to secure to the object of this paper, by dwelling upon points which may be deemed problematical, and will, therefore, simply state that every $37\frac{1}{2}$ cubic feet of water which could be collected by drainage and delivered each minute to a 10-foot wheel, represents the power of a horse, and it is obvious that when height becomes so important an element as it does in the calculation of motive power, it is more than probable that the waters which might be collected and supplied at higher levels within the watershed of main valleys, would go far to make up for the loss of power occasioned by the condemnation of mills below. But here, as in other respects, we are in ignorance of the rainfall at command in each locality, and there are no tangible data upon which to base calculations.

3. *Profitable Application of Surface and Drainage Water.*—This part of the subject is a very wide and interesting one, but we can only deal with it cursorily. All rain falling on a surface which from any cause is impermeable, either flows off its sloping surfaces to the outfalls, or rests on its flat or hollow surfaces until evaporation has reclaimed it; and all rain falling on a surface permeable in its natural state, or rendered so by underdraining, either finds its way down to the subterranean water level which feeds the springs at the out-crops, or to the level of the underdrains, which limit the height of stagnant water in all soils.

In each case a considerable portion of the rainfall may be made serviceable to man in some way or other, if quantity, quality, and altitude are favourable for appropriation. The floods which run off the surface may be impounded; the water that rests on the surface may be rescued from evaporation by underdraining; the water that escapes from the water-bearing strata is at all times available; and the water discharged from the underdrains may be concentrated by systematic arrangement.

In every instance, however, a precise knowledge of the rainfall is indispensable, and numberless are the occasions when a want of the knowledge has negatived all efforts

to convert the "evil of to-day" into the "benefit of to-morrow."

The various uses to which surface-waters and injurious under-waters discharged by drainage, may be applied, are in supplying towns and villages with water for domestic purposes, in irrigation, and as a motive power for machinery.

The impounding of surface and flood-waters in reservoirs in the higher valleys, has been long adopted in this country. Several towns, and nearly all the principal canals in England and Scotland, obtain their supply by this means of collection. Manchester has executed its works at Longdendale, and Liverpool at Rivington Pike. In Scotland, Edinburgh has done the like,--and Greenock has collected the water of an area of 5,000 acres, from Ducal Moss to Shaw's Hills, which not only supplies the town with water for domestic purposes, but furnishes two lines of mills with a quantity amounting to above 500,000,000 cubic feet annually. These instances, which might be multiplied by others, extending from north to south along the whole range of the earlier geological formations, are only referred to as illustrative of the application of surface-water by impounding in reservoirs, —a mode of conservation which would be extensively adopted for minor objects throughout the country, were the data of rainfall at command. As minor objects, we may point to irrigation and mill power, of which abundant examples already exist,—particularly in the mining districts of the west and the Highland farms of Scotland,—affording admirable instances of the profitable use of surface-water.*

The quality of the water supplied from impounding reservoirs, is always inferior to that derived from under-draining, to which the soil becomes a filter, and arrests the impurities which find their way into embanked valleys, and are fostered in open reservoirs. The use of drainage water, therefore, is an object which commends itself to the mind of all who consider it. If applied, as it frequently might be, to the supply of towns and villages, it has all the advantages of filtration, and the flow of the drains is never interrupted by frost so long as there is water in the land to discharge. The temperature of deep drainage water will be found to range from 37° to 40°, when the thermometer shows the temperature of the air to vary from 32° to 16°, or from freezing point to 16° below it. Now this is a point of much moment in considering the application of drainage water in rural villages. How many are the instances in which whole villages are destitute of water, and how frequently could the owner of adjacent lands supply the deficiency by concentrating, at a few pounds extra cost, the water he is throwing away when draining. In irrigation and in the supply of water to farm premises for cattle, or, if quantity favours, to put machinery in motion, the application of the non-freezing drainage water seems peculiarly desirable. At present it is seldom thought of, simply because the amount of rain which constitutes the primary supply is unknown, and because all attention is paid to the removal of the enemy (excess of water) without considering how readily that enemy might be converted into a friend. Moreover, a very large proportion of the under-drainage of this country is executed under the management of bailiffs and woodmen, who, in 9 cases out of 10, are quite incapable of devising a concentrating system of drainage, or who may never have seen a spirit level.

* At the Fowey-Consols mine in Cornwall, the water collected from one hill, is brought home by an aqueduct and delivered to 13 wheels in succession, of an aggregate power of 477 horses. Some interesting papers, elucidating this mode of collecting and applying water, were read before the Institution of Civil Engineers, "On the Bann Reservoirs, County Down, Ireland," and "On the Overshot-wheels at Wheal Friendship Mines, near Tavistock." Some good papers on reservoirs for agricultural purposes, are to be found in the "Journal of the Highland Society of Scotland."

In the case of Lord Hatherton, at Teddesley, we have an admirable instance of the application of drainage water to the two-fold purpose of motive power and irrigation. His lordship drained 467 acres of land at a cost of £1508 17s. 4d., and increased the rental £435 2s. 4d. (nearly 30 per cent.) He erected a water-wheel and machinery, and laid out irrigation at a cost of £1,224 4s. 10d., and gained £578 a year by the outlay. (See article Drainage, in the *Westminster Review*, 1842, by the writer.)

It is no sanguine view to declare that there are thousands of estates in the United Kingdom in which a similar advantage might be gained, as a proof of which, if we turn again to the Hinxworth Records, we shall find that the quantity of water (160,920 gallons per acre) which ran from the open mixed soils during the period of discharge, would supply power equal to one horse for 11 hours 17 minutes for every acre; so that if the discharge of the 400 acres (of the same soil) could be concentrated at one point—and in larger estates there would be no doubt of it—there would be available a power equal to six horses for 125 days. In my own practice, I have already applied the waters discharged from drainage for irrigation, and the tenants have gladly paid the demand of the owner by which the cost with interest has been liquidated.

As to the mode of obtaining, collecting, and publishing returns of the rainfall, several suggestions have been made. By some it was thought that a weekly return from every church clerk, or some other parochial officer, might be obtained; but inasmuch as the majority of church clerks and parochial officers in the rural districts are engaged in farming pursuits, and are oftimes away from home from early in the morning till late in the evening, and are otherwise disqualified by their habits and pursuits for the precise work of daily registration, that idea was soon abandoned. Another proposition was to make the returns of rainfall a branch of agricultural statistics. It is needless to say that, as the bill for the latter object was thrown out of Parliament, that proposal has not been encouraged, though there is no doubt the two objects are so allied as to admit of a useful union.

Up to this time, it would appear that no suggestion has been made which has received general approval. In the suggestions I shall venture to make, I purpose keeping to the simple object of a complete record of the fall of rain, without complicating that inquiry with any other. It is believed that a period of 20 years would suffice to obtain the desired information. Either of the several public bodies to which I have referred, i.e., the several national chartered Agricultural Societies, each for their separate country; or the Inclosure and Drainage Commissioners; or the Board of Health; or the Meteorological Societies; or the Registrar-General; are fully competent to act as a central official body for the collection, arrangement, and publication of returns, if the means for defraying the cost of an additional department were placed at their disposal. One responsible officer, as a registrar of rainfall, would suffice to control the department, and would cost, probably, on the whole, £1,200 to £1,500 a year.

The formation of a base of observations throughout the country and the appointment of competent and reliable observers is not so easily disposed of.

It is admitted on all hands that if the collection of these necessary returns were authorised by Parliament, it would not be advisable to trust wholly to voluntary observers, but that a certain number of paid observers* should

* By examining the returns of the Scottish Meteorological Society, it will be seen that the majority of observers are gardeners. Dr. Robinson, of Armagh, informs me that registers were kept at the several coast guard stations in Ireland, under the direction of the Royal Irish Academy, but they have been discontinued since 1851.

form the base of information, with a fore-knowledge that the number of voluntary contributors would increase the returns to any amount that might be considered desirable. The question that then arises is, who are the persons who could be relied upon for correct returns, and who would be satisfied with such an annual payment as would meet the views of the country? And what is the least number of stations that would suffice for a base of information? The class or description of persons who, it would appear, are competent and suitable, and who would, most likely, be content with a small return, are the masters of Unions, the masters of National Schools, the clerks at railway stations, and gardeners of superior establishments. And if the observations are confined to the rain-fall, there is no doubt that £5 per annum would be deemed by them an ample return for the trouble of recording and transmitting the returns weekly to the central office. This arrangement would, of course, involve the supply of the necessary rain guage to each observer.

It has been stated that if there was one paid station to every square of ten miles, or that if the paid stations were at a minimum distance of ten miles apart, it would suffice for all purposes, but this is not my belief. I consider that the distance between paid stations should not exceed a mean of five miles in the cultivated districts, and that the stations in the uncultivated and unprofitable districts should be fixed as near as circumstances would admit. The total area of the United Kingdom is 122,185 square miles, or 46,522,970 acres cultivated, and 30,871,463 uncultivated acres. If the base of information were determined to be one paid station to a square of ten miles, the number would be 1,222 stations, which at £5 per station would amount to £6,110 per annum. If the base were augmented to one paid station to every square of five miles of cultivated land, and one-fourth the number sufficed for uncultivated districts, the number would be 3,422 stations, and the cost £17,110 per annum. It is considered that by accepting the information of volunteers of a superior class, such as medical men, meteorologists, and other lovers of science, the number of observers might be readily increased, so as to meet local specialities of height, &c., if in return for the information so obtained the periodical publication of the registrar of rainfall was supplied to each correspondent.

The cost of rain gauges and fixing them may be estimated at 30s. each, taking as a basis the estimates of Mr. Casella and Messrs. Negretti and Co. The cost should be liquidated by annual instalments in the 20 years.

To maintain these gauges in working order (increased in expense by occasional changes of station and consequent damage), we must estimate the annual outlay at 25 per cent. of the first cost. To fix the guages after the presiding authorities have determined the stations, would require the aid, first of the survey department of the Ordnance to ascertain the height of each station and connect the whole with the Ordnance datum; and next, of superior officials, initiated in meteorology, to see that the guages are placed in a position free from the influence of trees and buildings, and in every respect in proper working order. The guages, when fixed, would require periodical inspection by an authorised officer, about once every year, and this would necessitate the maintenance of a staff of travelling inspectors.

The class of men required for inspectors of rain-guages would be practically the same as excisemen. It may be assumed that officers competent to perform the duties of excise supervisors would be equally capable of fixing and inspecting the guages, and of instructing observers on the mode of recording, &c., when once they where themselves initiated in their duties; and it might possibly be found desirable that the present staff of excise officers should be increased, so as to undertake the work.

These several items of annual expenditure amount to £27,270, if five-mile stations be adopted; and to £12,920 if ten-mile stations be adopted. Thus:—

For Five-Mile Stations.	£
Registrar's salary and expense of central office	1,500
Printing	1,000
Annual payment to observers	17,110
Annual instalment to repay first cost and fixing of rain-guages (7 per cent on £5,200)	375
Annual cost of maintaining the rain-guages in working order	1,285
Annual payments to inspectors of rain-guages	5,000
	£26,270

For Ten Mile Stations.	£
Central office and printing	2,200
Observers	6,110
Annual charge for payment of first cost and of rain-guages (7 per cent. on £2,100)	150
Cost of maintaining them	460
Inspectors	4,000
	£12,920

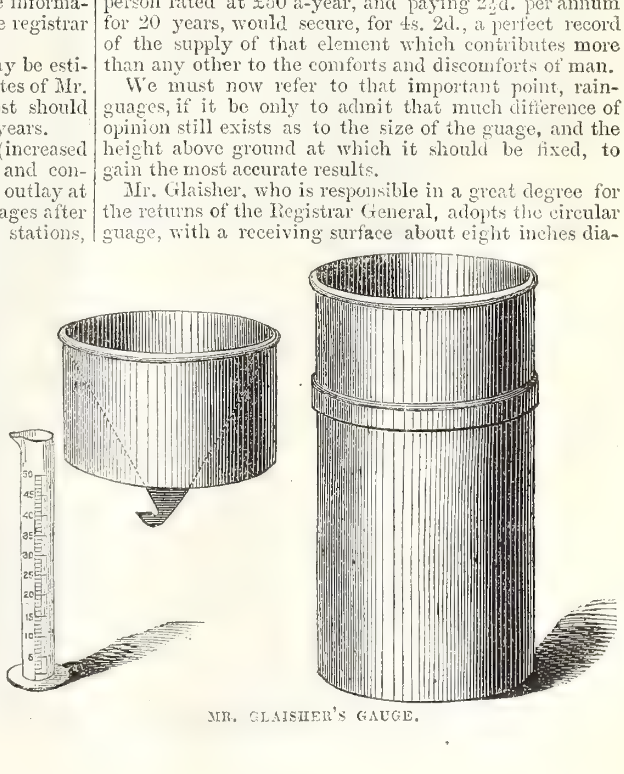
If the larger sum of the two were taken as the cost of obtaining an accurate and available return of the rainfall over the whole face of the country, it would result in a charge upon—

	£
England and Wales	15,000
Scotland	4,820
Ireland	6,200
British Isles	250
	£26,270

To represent this in a way that the country at large may be able to appreciate the extent to which they would individually subscribe, it should be stated that, to raise £26,270 on the rateable property of the United Kingdom, the charge would be one-tenth of a penny in the £1; or supposing the cost raised by county-rate, a person rated at £50 a-year, and paying 2½d. per annum for 20 years, would secure, for 4s. 2d., a perfect record of the supply of that element which contributes more than any other to the comforts and discomforts of man.

We must now refer to that important point, rain-guages, if it be only to admit that much difference of opinion still exists as to the size of the guage, and the height above ground at which it should be fixed, to gain the most accurate results.

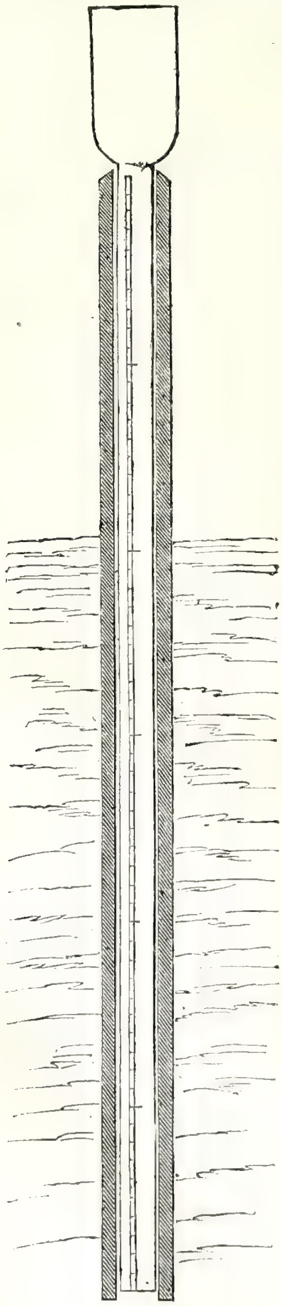
Mr. Glaisher, who is responsible in a great degree for the returns of the Registrar General, adopts the circular guage, with a receiving surface about eight inches dia-



MR. GLAISHER'S GAUGE.

meter, so fixed as to be five inches above ground.—(See "Meteorology," by James Glaisher, 1857.)

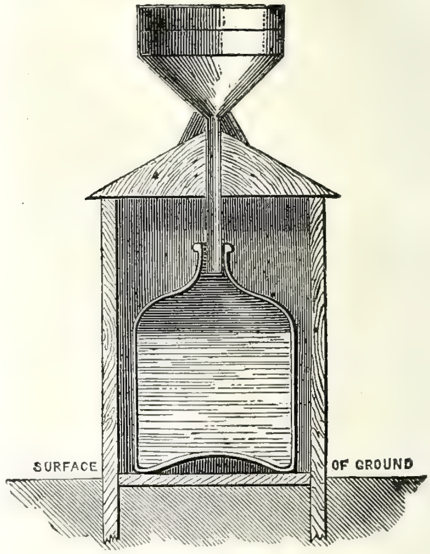
Mr. J. Bennett Lawes, of Rothampstead, who for a long time has taken a great interest in the subject, and has compared the daily results given by a guage of a size equal to $\frac{1}{1000}$th part of an acre with those of a small guage five inches in diameter, has given it as his opinion that the larger the guage the more accurate the return.—(See *Gardeners' Chronicle*, page 180, 1853.)



MR. STRATON'S GAUGE.

This, however, is directly opposed to the opinion of Mr. Straton, of Aberdeen, who, after careful investigation, has given it as his opinion that circular glass gauges 1, 2, or 3 inches in diameter, placed 15 inches above the surface, are the best guages that can be used, (See *Edinburgh New Philosophical Journal*, July, 1853,) and Mr. Welsh, of the Kew Observatory, states, in a note addressed to me, that he thinks "that there is much reason in what Mr. Straton says."

Mr. Homersham, in his report on the supply of water to Manchester, Salford, and Stockport (1848), has given the results of a series of experiments and records, which tend to shew that Mr. Glaisher's rain-gauges (to which he gives preference for some purposes) would not have answered in all cases.



MR. HOMERSHAM'S GUAGE.

These conflicting opinions upon the very instrument by which we should measure the rainfall, lead us to the conclusion that the first step to be adopted by the authorities by whom the general registration would be conducted, would be to determine the size and shape of the guage, the height at which it should be placed under different circumstances, and the material of which it should be made. These points can only be determined by public authorities who have competent means of investigating them in a manner which no private individual can accomplish, and it would be no small gain to science if public necessity determined where errors have existed, and in what way they may be avoided in future.

In conclusion, I must remark that I have approached the object of this evening's discussion with considerable diffidence. I have felt that the subject of rainfall was only one branch of a very comprehensive science, and that it was hardly possible to do justice to it without embracing several kindred elements; and the time I have been able to devote to the subject, reduced as it has been to the closest limits, has been insufficient to allow me to do it justice even in its reduced shape. But I have been influenced by the conviction, forced on me by my daily practice as an agricultural engineer, that we are working in the dark, and I have wished, for my own sake, and for the sake of those who are following the same pursuits, to rescue the present generation from the opprobrium which must attach to it when its performances are tested by the experience and better data possessed by the next.

APPENDIX.—HINXWORTH DRAINAGE.—MONTHLY RECORDS FROM 1st OCTOBER, 1856, TO 31st MAY, 1857.

RECORD FOR OCTOBER, 1856.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	RAINFALL.		BAROMETER.	OCCASIONAL DRAINAGE.—FIELDS Nos. 18, 19, 20. 46 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Green Sand is found mixed with Gault Clay. Also Coprolites. Very wet before Draining. Nos. 19 and 20 only, containing 25 acres, drained at this time.				PART OCCASIONAL AND PART WIDE PARALLEL DRAINAGE. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed.		PARALLEL DRAINAGE. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856.		CLOSE PARALLEL DRAINAGE. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep.					TEMPERATURE. At half-past Seven, a.m.					
				Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Holes 6 feet deep.		Quantity of Water from Outlet No. 7, which discharges the Drain Water from 18, 19, and 20. Size of Pipe, 8 inches. Commenced running October 1.		Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.		Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.		Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Holes dug 5 feet deep.			Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.		Undrained Land.			Drained Land.		
												Drained Land.										
Day of the Month.	Per Diem. Inches dec.	Per Acre. (Per Diem.) In Gallons.	Height at the time of recording the Discharge from the Outlets, 8 o'clock a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	Higher Side.—Distance from Drain to Drain 59 yds. Depth of Drains 4 ft. 11 in.	Lower Side.—Distance from Drain to Drain 57 yds. Depth of Drains 4 ft. 4 in.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Higher Side. 25 ft. apart and 4 ft. deep. No. 31.	Lower Side. 25 ft. apart and 4 feet deep. No. 31.	Undrained Land. No. 33.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Of Air 9 inches above surface. No. 33.	Of Soil 18 inches below ground. No. 33.	Of Soil 42 inches below ground. No. 33.	Of Air 9 inches above surface. No. 31.	Of Soil 18 inches below ground. No. 31.	Of Soil 42 inches below ground. No. 31.
1	...	...	No record of the changes of the barometer made before 21st October, 1856.	5 11	5 4	$1\frac{1}{4}$	75	Nil	Nil	$1\frac{1}{4}$	75	Nil	Nil	No observations made this month.	Nil	Nil	No observations made this Month on the Temperature of the Soil.					
2	...	...		5 10	5 3	$1\frac{3}{4}$	105	...	...	$1\frac{1}{4}$	75	Nil	Nil		...	...						
3	...	...		5 9	5 2	$1\frac{3}{8}$	80	...	...	$1\frac{1}{4}$	75	4 $9\frac{1}{2}$	4 9		...	...						
4	·105	2,375		5 8	5 0	$1\frac{1}{2}$	90	...	...	$1\frac{1}{4}$	75	4 $9\frac{1}{2}$	4 9		...	...						
5	·200	4,525		5 6	4 10	2	120	...	...	$1\frac{3}{4}$	75	4 9	4 $8\frac{1}{2}$		...	...						
6	·060	1,355		5 $3\frac{1}{2}$	4 8	$1\frac{3}{8}$	80	...	...	$1\frac{3}{8}$	80	4 $8\frac{1}{2}$	4 8		...	...						
7	·080	1,810		5 2	4 5	2	120	...	...	$1\frac{3}{4}$	105	4 9	4 $8\frac{1}{2}$		...	...						
8	·185	4,185		5 0	4 $3\frac{1}{2}$	$2\frac{5}{8}$	160	...	...	$19\frac{1}{3}$	1,160	4 10	4 $9\frac{3}{4}$		...	...						
9	·040	905		4 10	4 2	4	235	...	...	$6\frac{3}{4}$	405	4 $10\frac{1}{2}$	4 10		...	...						
10	·060	1,355		4 9	4 1	$6\frac{1}{4}$	360	...	...	$6\frac{3}{4}$	405	4 11	4 $10\frac{1}{2}$		...	...						
11	·195	4,410		4 8	3 11	9	530	...	...	$6\frac{1}{2}$	390	4 $11\frac{1}{2}$	4 11		...	...						
12	·415	9,390		4 6	3 7	$27\frac{1}{2}$	1,585	1-4th	20	30	1,700	4 $10\frac{1}{2}$	4 10		...	...						
13	·005	115		4 5	3 8	24	1,410	1-4	20	$8\frac{1}{3}$	470	4 11	4 11		...	...						
14	...	...		4 4	3 9	$19\frac{1}{2}$	1,115	1-8	10	$3\frac{1}{4}$	210	Nil	Nil		...	...						
15	·115	2,600		4 $4\frac{1}{2}$	3 $9\frac{1}{2}$	15	880	1-8	10	4	235	...	...		...	...						
16	·070	1,585		4 5	3 10	$10\frac{1}{2}$	605	1-8	10	6	350	...	...		...	...						
17	·100	2,260		4 $5\frac{1}{2}$	4 0	10	580	1·8	10	6	350	...	...		...	...						
18	·005	115		4 6	4 2	9	530	1-8	10	7	400	...	...		...	...						
19	...	...		4 $6\frac{1}{2}$	4 2	$8\frac{1}{2}$	495	1-8	10	6	350	...	...		...	...						
20	...	...		4 7	4 2	8	470	1-8	10	4	235	...	...		...	...						
21	...	...	30·12	4 7	4 2	8	470	1-9	9	$3\frac{1}{2}$	210	...	...		...	...						
22	...	...	30·28	4 $7\frac{1}{2}$	4 $2\frac{1}{2}$	7	400	1 9	9	$3\frac{1}{4}$	195	...	..		...	...						
23	...	...	30·26	4 8	4 3	$6\frac{1}{2}$	375	1-10	8	3	180	...	...		...	...						
24	...	...	30·38	4 $8\frac{1}{2}$	4 3	6	350	1-12	7	3	180	...	...		...	...						
25	...	...	30·40	4 9	4 3	6	350	1-16	5	$2\frac{3}{4}$	165	...	...		...	...						
26	...	...	30·39	4 9	4 3	5	285	1-16	5	$2\frac{1}{2}$	150	...	...		...	...						
27	...	...	30.36	4 $9\frac{1}{2}$	4 3	$4\frac{1}{4}$	250	1-16	5	$2\frac{5}{8}$	140	...	...		...	...						
28	·002	45	30·28	4 10	4 3	4	235	1-16	5	$2\frac{1}{3}$	130	...	...		...	...						
29	·003	70	30·20	4 10	4 3	$3\frac{3}{4}$	220	1-16	5	2	120	...	...		...	...						
30	...	...	30·10	4 10	4 3	3	175	1-16	6	2	120	...	...		...	...						
31	·005	115	30·05	4 10	4 3	3	175	1-16	5	$1\frac{3}{4}$	105	...	...		...	...						
Total	1·645	37,215		Total quantity of Water per acre discharged			12,910		178		9,815											
				Remainder unaccounted for			24,305		37,037		28,800											
				Total Rainfall			37,215		37,215		37,215											

HINXWORTH DRAINAGE.—RECORD OF THE MONTH OF NOVEMBER, 1856.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	RAINFALL.		BAROMETER.	OCCASIONAL DRAINAGE.—FIELDS Nos. 18, 19, 20. 46 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Green Sand is found mixed with Gault Clay. Also Coprolites. Very wet before draining. Nos. 19 and 20 only drained up to Nov. 10, when the draining of Nov. 18 was commenced. It was finished Nov. 29.				PART OCCASIONAL AND PART WIDE PARALLEL DRAINAGE. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed.		PARALLEL DRAINAGE. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856.		CLOSE PARALLEL DRAINAGE. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart and 4 feet deep.					TEMPERATURE. At half-past Seven, a.m.					
				Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Holes 6 feet deep.		Quantity of Water from Outlet No. 7, which discharges the Drain Water from 18, 19, and 20. Size of Pipe, 8 in. Commenced running October 1.		Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.		Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.		Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Holes 5 feet deep. Drained Land.			Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.		Undrained Land.			Drained Land.		
Day of the Month.	Per diem. Inches dec.	Per Acre. (Per Diem.) In Gallons.	Height at the time of recording the Discharge from the Outlets, 8 o'clock, a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	Higher Side.—Distance from Drain to Drain 59 yds. Depth of Drains 4 ft. 11 in.	Lower Side.—Distance from Drain to Drain 57 yds. Depth of Drains 4 ft. 4 in.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Higher Side. 25 ft. apart and 4 ft. deep. No. 31.	Lower Side. 25 ft. apart and 4 ft. deep. No. 31.	Undrained Land. No. 33.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Of Air 9 inches above surface. No. 33.	Of Soil 18 inches below ground. No. 33.	Of Soil 42 inches below ground. No. 33.	Of Air 9 inches above surface. No. 31.	Of Soil 18 inches below ground. No. 31.	Of Soil 42 inches below ground. No. 31.
1	·312	7,058	30·28	4 10	4 3	9½	555	1–8th	10	2¾	165	Nil	Nil	No observations made prior to November 27.	Nil	Nil	No observations made this Month on the Temperature of the Soil.					
2	·003	68	30·29	4 10	4 3	5	285	1–9	9	1¾	105	...	...		...	...						
3	...	...	30·19	4 10	4 3	3	175	1–10	8	1½	90	...	...		...	...						
4	...	...	30·18	4 10	4 3	3	175	1–10	8	1¼	75	...	...		...	...						
5	...	...	30·30	4 10	4 3	3	175	1–10	8	1	60	...	...		...	...						
6	...	...	30·40	4 10	4 3	3	175	1–10	8	1	60	...	...		...	...						
7	·005	113	30·50	4 10	4 3	3	175	1–10	8	1	60	...	...		...	...						
8	...	...	30·37	4 10	4 3	3	175	1–10	8	1½	90	...	...		...	...						
9	·355	8,030	30·06	4 10	4 3	12	700	2–3	50	6	360	...	...		...	...						
10	·005	113	29·50	4 10	4 3	5⅗	Field No. 18 being drained and added to this outlet, and the daily measurements were only approximately taken.	3–8	30	5½	330	...	...		...	...						
11	...	...	29·30	4 10	4 3	5		3–8	30	5½	330	...	...		...	...						
12	·215	4,864	29·60	4 9	4 3	6⅞		1–2	40	5½	330	...	...		...	...						
13	·002	45	29·70	4 9	4 3	7		1–2	40	5	300	...	...		...	...						
14	·003	68	29·79	4 9	4 3	7½		3–8	30	4¾	285	...	...		...	...						
15	...	...	29·80	4 9	4 3	7½		3–8	30	4¾	285	...	...		...	...						
16	...	...	30·10	4 9	4 3	8		1–4	20	3½	210	...	...		...	...						
17	...	...	30·10	4 9	4 3	9		1–4	20	2½	150	...	...		...	...						
18	·040	905	30·00	4 9	4 3	9		1–4	20	2¼	135	...	...		...	...						
19	·072	1,628	30·04	4 9	4 3	12½		1–3	25	2¼	135	...	...		...	...						
20	·053	1,199	29·09	4 9	4 3	15		1–2	40	2¼	135	...	...		...	...						
21	·005	113	30·15	4 9	4 3	15¾		1–2	40	2¼	135	...	...		...	...						
22	...	...	30·17	4 9	4 3	16		1–3	25	2¼	135	...	...		...	...						
23	...	...	29·70	4 9	4 3	16		1–3	30	2¼	135	...	...		...	...						
24	...	...	29·60	4 9	4 3	17		1–3	25	2¼	135	...	...		...	...						
25	...	...	29·50	4 9	4 3	17		1–3	30	2¼	135	...	...		...	...						
26	·015	339	29·60	4 9	4 2½	17¾		1–3	25	3¼	195	...	...		...	...						
27	·540	12,216	29·58	4 8	4 2	33		11¼	900	12¼	735	4 11	4 11	3 0	2¾	135						
28	·005	113	29·68	4 7	4 0	34½		3	240	5	300	4 11½	4 11½	2 10	1¼	65						
29	...	...	29·68	4 7½	4 1	32		2	160	4	240	...	...	2 10	1¼	65						
30	...	...	29·69	4 7½	4 1	30		2	160	3	180	...	...	2 9½	1¼	65						
Total	1·630	36,872		Total quantity of Water per acre discharged			27,000		2,077		6,015					330						
	1·645	37,215		Remainder unaccounted for			9,872		34,795		30,857					36,542						
	3·275	74,087		Total Rainfall			36,872		36,872		36,872					36,872						

HINXWORTH DRAINAGE.—Record of the Month of December, 1856.

Day of the Month.	1. Rainfall. Per diem. Inches dec.	2. Rainfall. Per Acre. (Per Diem.) In Gallons.	3. Barometer. Height at the time of recording the Discharge from the outlets, 8 o'clock, a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	4. Occasional Drainage.—Fields Nos. 18, 19, 20. 16 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Green Sand is found mixed with Gault Clay. Also Coprolites. Very wet before Draining. Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes 6 feet deep. Higher Side—Distance from Drain to Drain 59 yds. Depth of Drains 4 ft. 11 in.	5. Lower Side.—Distance from Drain to Drain 57 yds. Depth of Drains 4 ft. 4 in.	6. Quantity of Water from Outlet No. 7, which discharges the Drain Water from 18, 19, and 20. Size of Pipe, 8 inches. Commenced running October 1. Per Minute. In Gallons.	7. Per Acre. In Gallons (per diem).	8. Part Occasional and part Wide Parallel Drainage. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed. Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12. Per Minute. In Gallons.	9. Per Acre. In Gallons (per diem).	10. Parallel Drainage. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856. Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year. Per Minute. In Gallons.	11. Per Acre. In Gallons (per diem).	12. Close Parallel Drainage. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep. Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. Test holes dug 5 feet deep. Drained Land. Higher Side. 25 ft. apart and 4 ft. deep. No. 31.	13. Drained Land. Lower Side. 25 ft. apart and 4 ft. deep. No. 33.	14. Undrained Land. No. 33.	15. Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27. Per Minute. In Gallons.	16. Per Acre. In Gallons (per diem).	17. Temperature. At half-past Seven, a.m. Undrained Land. Of Air 9 inches above surface. No. 33.	18. Of Soil 18 inches above ground. No. 33.	19. Of Soil 42 inches below ground. No. 33.	20. Drained Land. Of Air 9 inches above surface. No. 31.	21. Of Soil 18 inches below ground. No. 31.	22. Of Soil 42 inches below ground. No. 31.
1	..	...	29 80	4 8	4 1	28½	895	1½	120	4⅞	295	Nil	Nil	2 9	1¼	65						
2	...	...	29·80	4 8	4 1	25	780	1¾	140	3½	210	...	...	2 7	1⅛	55						
3	...	...	29·69	4 8	4 1½	22½	695	1⅞	150	2¼	135	...	...	2 6	⅝	30						
4	...	...	29 90	4 8	4 1½	20	620	1⅞	150	2	120	...	...	2 6	⅝	30						
5	·073	1,651	29·59	4 8	4 1½	25½	795	1⅞	150	3⅜	200	...	...	2 5	¾	40						
6	·027	610	29 40	4 8	4 1½	24½	735	1⅛	150	3⅜	200	...	...	2 5½	¾	40						
7	·050	1,131	29·49	4 8	4 1½	25½	795	2	160	4	235	...	...	2 5	⅞	45						
8	...	...	29·49	4 8	4 1½	24½	735	2¼	180	4¾	225	...	...	2 4½	⅞	45						
9	·080	1,810	29·40	4 8	4 1½	27	830	3	240	5	300	...	...	2 4	⅞	45						
10	·063	1,357	29 30	4 8	4 1½	26¼	820	3	240	5¼	315	4 11½	4 11	2 4	1	50						
11	·075	1,696	29·40	4 8	4 1½	24	755	6	480	15	900	4 11	4 11	2 4	2	100						
12	·085	1,923	29·27	4 8	4 1½	22½	695	8	640	22½	1,250	4 10½	4 10	2 3½	3⅕	160						
13	·452	10,225	28·89	3 8	2 11	77½	2,420	19	1,520	47½	2,850	4 9	4 9	6	19½	975						
14	·023	520	29·40	3 10	3 0	55	1,715	10	800	25	1,500	4 9	4 8	7	15	750						
15	.	...	30·20	3 10	3 2	47½	1,485	6	480	15¾	945	4 9	4 8	7	13½	675						
16	...	...	30·49	4 0	3 7	47½	1,485	6	480	10½	630	4 9	4 8	10	7½	375						
17	...	.	30 37	4 1	4 0	46¾	1,455	6	480	9	540	4 9	4 8	10½	8¼	415						
18	...	...	29·80	4 0½	4 0½	40	1,245	5⅝	450	6¾	405	4 9	4 8	11	3¾	185						
19	·100	2,262	30·30	4 2	4 2	34¼	1,085	6⅞	550	8	480	4 9	4 8	1 0	4¼	225						
20	·005	113	30·38	4 2	4 2	37	1,145	6½	520	7½	450	4 9	4 8	1 1	3⅕	160						
21	...	...	30·39	4 2	4 2	35	1,095	5¾	460	7½	450	4 9	4 8	1 1	3	150						
22	...	...	30·00	4 2½	4 2½	33	1,030	5¼	420	7½	450	4 9	4 9	1 2	2½	125						
23	...	...	29·90	4 4	4 4	33	1,030	4⅞	395	7½	450	4 8	4 9	1 4	2¼	110						
24	·045	1,018	29·40	4 3	4 3	35	1,095	4¾	330	7	420	4 8	4 9	1 4	2	100						
25	...	...	28·80	4 5	4 5	30	935	4½	360	6	360	4 8	4 10	1 4	2	100						
26	...	...	28·70	4 6	4 6	26¼	820	4¼	340	5¼	315	4 8	4 10	1 4	1⅞	95						
27	...	...	29·19	4 6	4 6	21	660	3½	280	4	235	4 9	4 10	1 4	1¼	65						
28	...	...	29·46	4 6½	4 6½	19	595	3	240	3	180	4 9	4 10	1 4	1	50						
29	...	...	29·80	4 7	4 7	15¼	935	2¼	180	2⅝	160	4 9	4 10	1 4	¾	40						
30	·150	3,393	30·10	4 6	4 6	19	595	5	400	6½	390	4 7	4 9	1 3	6	300						
31	·010	226	30·14	4 6½	4 2	18¾	590	4½	360	5⅝	340	4 6½	4 9	1 3	4½	225						
Total	1·235	27,935		Total quantity of Water per Acre discharged			30,565		11,895		15,935					5,825						
				Rainfall			27,935	Difference unaccounted for..	26,040		12,000					22,110						
				Excess discharged from the Soil			2,630	Rainfall	27,935		27,935					27,935						

No observations made this Month on the Temperature of the Soil.

HINXWORTH DRAINAGE.—Record of the Month of January, 1857.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Rainfall.		Barometer.	Occasional Drainage.—Fields Nos. 18, 19, 20. 46 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Green Sand is found mixed with Gault Clay. Also Coprolites. Very wet before Draining.				Part Occasional and part Wide Parallel Drainage. Field No. 22. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed.		Parallel Drainage. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856.		Close Parallel Drainage. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep.					Temperature. At half-past Seven, a.m. Undrained Land.			Drained Land.		
				Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes 6 feet deep.		Quantity of Water from Outlet No. 7, which discharges the Drain Water from 18, 19, and 20. Size of Pipe, 8 inches. Commenced running October 1.		Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.		Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.		Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Test Holes 5 feet deep. Drained Land.			Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.							
Day of the Month.	Per Diem. Inches dec.	Per Acre. (Per Diem.) In Gallons.	Height at the time of recording the Discharge from the Outlets, 8 o'clock a.m. Note.—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	Higher Side.—Distance from Drain to Drain 59 yds. Depth of Drains 4 ft. 11 in.	Lower Side.—Distance from Drain to Drain 57 yds. Depth of Drains 4 ft 4 in.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem.)	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem.)	Higher side. 25 ft. apart and 4 feet deep. No. 31.	Lower Side. 25 ft. apart and 4 feet deep. No. 31.	Undrained Land No. 33.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Of Air 9 inches above surface. No. 33.	Of Soil 18 inches below ground. No. 33.	Of Soil 42 inches below ground. No. 33.	Of Air 9 inches above surface. No. 31.	Of Soil 18 inches below ground. No. 31.	Of Soil 42 inches below ground. No. 31.
1	005	113	30 30	4 6	4 2	16	500	2½	200	4¼	250	4 6	4 6	1 2	2	100	No observations made prior to the 6th of this month.					
2	·020	452	29·48	4 6	4 2	21	660	3¾	300	5	300	4 6	4 6	1 2	3⅜	170						
3	·042	950	29·20	4 6	4 2	24	750	5	400	9¼	550	4 5	4 5	1 2	8	400						
4	·151	3,416	29 07	4 6	4 1	29	900	14½	1,150	33	1,900	4 4	4 4	1 2	18	900						
5	·162	3,665	29·64	4 6	4 1	31	980	15¾	1,260	40½	2,430	4 3	4 3	1 1½	21	1,050						
6	...	...	30·09	4 5½	4 0½	30	930	11¼	900	19½	1,170	4 3	4 3½	1 3	12	600	31	...	No observations recorded.	31	...	No observations recorded.
7	...	...	30·29	4 5	4 0	31½	995	7¼	580	18½	1,130	4 3	4 3½	1 2½	4½	225	32	34		33	34	
8	...	...	30·24	4 5	4 1	28½	895	5¼	420	9	540	4 3	4 3	1 3	3	150	34	34		36	35	
9	·035	792	30 13	4 4½	4 0	29	910	5	400	8	480	4 3	4 3½	1 3	2⅝	125	37	35		38	36	
10	·542	12,261	29·46	3 5	2 8	62	1,945	45	3,600	101½	6,060	4 0	4 0	0 5	103	5,150	44	36		44	37	
11	·300	6,787	28·80	3 0	2 2	57½	1,800	40	3,200	75	4,500	4 0	4 0	0 5	88	4,000	37	37		43	38	
12	·162	3,665	29·19	2 1	1 11	53¾	1,680	30¾	2,460	46½	2,790	3 11	3 11	0 4	40	1,990	37	37		32	38	
13	...	...	29·39	2 7	2 5	55	1,720	22½	1,800	35	2,085	4 0	4 0	0 5	25	1,250	32	37		31	37	
14	...	...	29·80	3 2	2 11	55	1,720	12¾	1,020	18	1,080	4 0	4 0	0 6	12	600	28	36		29	37	
15	...	...	29·90	3 6	3 3	50	1,560	9	720	11¼	660	4 0	4 0	0 9	7½	375	32	35		33	35	
16	·135	3,054	29 90	3 10	3 8	52½	1,640	9¾	780	14¼	840	4 1	4 1	1 0	8¼	410	27	34		31	35	
17	...	...	30·20	4 1½	4 0	51½	1,605	9	720	13½	840	4 1½	4 2	1 0	7½	375	29	31		33	34	
18	·005	113	30·19	4 2	4 0	48	1,500	9	720	14¼	850	4 1	4 2	1 0	7½	375	43	30		44	35	
19	·005	113	30·17	4 3½	4 1	45	1,395	9	720	15¾	945	4 1	4 2	1 0	7½	375	41	36		42	36	
20	...	...	29·69	4 3	3 11½	43¾	1,350	9¾	780	16¾	1,005	4 0	4 0	1 0½	8¼	410	38	32		39	37	
21	·065	1,470	29·40	4 2	3 11	50	1,560	16½	1,320	24	1,440	3 10½	3 10	1 0	13½	680	32	31		32	36	
22	·120	2,714	29·69	4 1	3 10	52½	1,640	17¼	1,380	24¾	1,485	3 10	3 10	0 10	19¾	985	29	32		30	37	
23	·062	1,402	29·28	4 0½	3 9	53¾	1,680	18	1,440	24	1,440	3 9	3 9	0 9	19¾	985	32	31		34	35	
24	·035	792	29·04	4 1	3 10	52½	1,640	16½	1,320	22¼	1,310	3 9½	3 9	0 10	18	900	35	33		36	37	
25	·145	3,280	29·27	4 0	3 8	61	1,900	37½	3,000	56¼	3,400	3 8	3 9	0 10	54	2,700	34	32		35	36	
26	·130	2,940	29·59	3 7	3 7	62½	1,960	45	3,600	57½	3,450	3 5	3 9	0 10	55	2,750	31	32		32	34	
27	·112	2,534	29·70	3 7	3 3	57½	1,800	21	1,680	41½	2,460	3 2½	3 2½	1 0	35	1,750	28	33		29	35	
28	...	...	29·79	3 9	3 5	56¼	1,770	11	880	20¼	1,200	3 3	3 3	1 0	15	750	17	33		18	35	
29	...	...	29·70	3 10½	3 6½	51¼	1,595	10½	840	16⅔	995	3 3½	3 3½	1 0	11¼	560	16	32		17	34	
30	...	...	29·73	4 0	3 9	45	1,395	9	720	13¼	795	3 4	3 4	1 0	6¾	340	21	31		22	33	
31	·100	2,262	29·58	4 0½	3 8	47½	1,480	9¾	780	15	900	3 3	3 3	0 11	7½	375	30	33		31	34	
Total	2.333	52,775		Total quantity of Water per acre discharged			43,855		39,090		49,250					31,805						
				Remainder unaccounted for			8,920		13,685		3,525					20,970						
				Total Rainfall			52,775		52,775		52,775					52,775						

HINXWORTH DRAINAGE.—Record of the Month of February, 1857.

Rainfall (columns 1, 2).

Barometer (column 3).

Occasional Drainage.—Fields Nos. 18, 19, 20. 16 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Green Sand is found mixed with Gau t Clay. Also Coprolites. Very wet before Draining. (Columns 4–7.)

Part Occasional and part Wide Parallel Drainage. Field No. 22. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed. (Columns 8, 9.)

Parallel Drainage. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856. (Columns 10, 11.)

Close Parallel Drainage. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep. (Columns 12–16.)

Temperature. At half-past Seven, a.m. (Columns 17–22.)

Columns 4, 5: Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes 6 feet deep.

Columns 6, 7: Quantity of Water from Outlet No. 7, which discharges the Drain Water from 18, 19, and 20. Size of Pipe, 8 inches. Commenced running October 1.

Columns 8, 9: Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.

Columns 10, 11: Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.

Columns 12–14: Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Test Holes 5 feet deep. Columns 12, 13: Drained Land.

Columns 15, 16: Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.

Columns 17–19: Undrained Land. Columns 20–22: Drained Land.

Day of the Month.	1. Per Diem. Inches dec.	2. Per Acre. (Per Diem.) In Gallons.	3. Height at the time of recording the Discharge from the Outlets, 8 o'clock a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	4. Higher Side.—Distance from Drain to Drain 59 yds. Depth of Drains 4 ft. 11 in.	5. Lower Side.—Distance from Drain to Drain 57 yds. Depth of Drains 4 ft. 4 in.	6. Per Minute. In Gallons.	7. Per Acre. In Gallons (per diem.)	8. Per Minute. In Gallons.	9. Per Acre. In Gallons (per diem).	10. Per Minute. In Gallons.	11. Per Acre. In Gallons (per diem).	12. Higher Side. 25 ft. apart and 4 feet deep. No. 31.	13. Lower Side. 25 ft. apart and 4 feet deep. No. 31.	14. Undrained Land. No. 33.	15. Per Minute. In Gallons.	16. Per Acre. In Gallons (per diem).	17. Of Air 9 inches above surface. No. 33.	18. Of Soil 18 inches below ground. No. 33.	19. Of Soil 42 inches below ground. No. 33.	20. Of Air 9 inches above surface. No. 31.	21. Of Soil 18 inches below ground. No. 31.	22. Of Soil 42 inches below ground. No. 31.
1	...	...	29·79	4 1	3 8	40	1,245	7	560	12	720	...	...	1 0	7	350	27	32	No observations recorded prior to the 21st of this month.	28	33	39
2	...	...	29·59	4 2	3 8½	33¾	1,055	6¾	540	8¼	495	3 1½	3 3½	1 0	6	300	25	32		26	33	39
3	...	...	29·60	4 3½	3 9	32½	1,015	6	480	6¾	405	3 2	3 4	1 1	5¼	260	21	32		22	33	38
4	...	...	30·07	4 5	3 10	32½	1,015	4½	360	5¼	315	3 3	3 5	1 2	3¾	185	24	31		25	32	38
5	...	...	30·08	4 6	3 11½	35	1,095	6	480	6¾	405	3 4	3 6	1 2	5¼	265	26	32		27	33	38
6	·100	2,262	29·77	4 5	3 11	38¾	1,210	12¾	1,020	9½	570	3 2	3 4	1 2	9	450	27	32		28	33	38
7	·025	565½	29·67	4 4	3 10	50	1,560	16½	1,320	31½	1,890	2 10	3 0	1 0	25	1,250	40	31		41	33	38
8	...	...	29·59	4 4	4 0	45	1,395	12	960	18	1,080	2 10	2 11	1 0	17	850	38	32		39	34	38
9	...	...	29·58	4 4	4 1	41½	1,285	9	720	10½	630	2 10	2 11	1 0	12	600	44	32		45	33	38
10	·022	497½	29·57	4 5	4 2	40	1,245	9	720	9¾	585	2 10	2 11	1 1	9	450	35	33		36	34	37
11	·020	452½	29·69	4 6	4 3	37½	1,175	8½	680	10½	630	3 0	2 11	1 2	7½	375	35	34		36	35	37
12	·010	226¼	30·20	4 7	4 4	36½	1,150	6¾	540	9¾	585	3 1	3 0	1 2	7½	375	31	35		32	36	38
13	...	...	30·20	4 7½	4 4	37½	1,175	6¾	540	9¾	585	3 2	3 1	1 2	7½	375	32	35		33	36	38
14	...	...	30·20	4 8	4 4	35	1,090	6¾	540	9	540	3 3	3 2	1 2½	7½	375	40	34		40	35	38
15	...	...	30·16	4 8	4 4	32	1,000	6	480	8¾	525	3 3	3 2	1 3	6½	325	32	34		33	35	38
16	...	...	30·05	4 9	4 4	30	935	6	480	8¾	525	3 4	3 3	1 3	6	300	25	35		25	36	39
17	...	...	30·00	4 9½	4 4	27½	860	4½	360	7½	450	3 4½	3 4	1 3	5¼	260	42	35		41	35	40
18	...	...	29·90	4 10	4 4	27½	860	4½	360	6¼	375	3 5	3 5	1 3½	4½	225	40	35		40	36	40
19	...	...	30·09	4 10½	4 4	26¼	820	4½	360	6¼	375	3 5½	3 6	1 3½	3¾	185	42	35		41	37	40
20	·015	339¼	30·14	4 10½	4 4	25	780	4½	360	5	300	3 6	3 6½	1 3½	3¾	185	40	36		39	38	40
21	...	...	30·18	4 11	4 4	23¾	745	4	320	5	300	3 6½	3 7	1 4	3	150	42	37		40	39	41
22	...	...	30·19	4 11	4 4	22	690	4	320	4	240	3 7	3 8	1 5	3	150	42	37		42	39	41
23	...	...	30·19	4 11	4 4	21	660	4	320	3¾	225	3 7	3 8	1 5½	3	150	34	37	39	34	39	41
24	...	...	30·20	4 11	4 4	21	660	3¾	300	3	180	3 7½	3 8	1 6	3	150	40	37	39	40	39	41
25	...	...	30·10	4 11	4 4	21	660	3¾	300	3	180	3 8	3 8½	1 6	3	150	30	37	39	31	39	41
26	...	...	30·38	4 11	4 4	21	660	3¾	300	3	180	3 8	3 9½	1 6	3	150	23	37	39	23	39	41
27	...	...	30·37	4 11	4 4	21	660	3¾	300	3	180	3 8	3 10½	1 6	2¼	110	36	37	39	36	39	41
28	...	...	30·39	4 11	4 4	21	660	3¾	300	3	180	3 8½	3 11½	1 6	2¼	110	43	37	39	43	39	41
Total	·192	4,343		Total quantity of water per acre discharged			27,360		14,320		13,650					9,060						
				Rainfall			4,343		4,343		4,343					4,343						
				Excess discharged from soil			23,017		9,977		9,307					4,717						

HINXWORTH DRAINAGE.—Record of the Month of March, 1857.

	1	2	3	4	5	6	7	8	9	10	11	12	13	11	15	16	17	18	19	20	21	22
	Rainfall.		Barometer.	Occasional Drainage.—Field No. 40. 16 Acres.—Soil, lower Chalk mixed with Clay Gravel and Sand. Very wet before Draining. (The fields are changed because Coprolites were raised in No. 19 this month, and interfered with the discharge).				Part Occasional and part Wide Parallel Drainage. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed.		Parallel Drainage. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856.		Close Parallel Drainage. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep.					Temperature. At half past Seven, a.m.					
				Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes, 8 feet deep.		Quantity of Water from Outlet No. 8, which discharges the Drain Water from Field No. 40.		Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22 Size of Pipe, five inches. Commenced running October 12.		Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14 Size of Pipe, 5 inches. Has run throughout the year.		Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Holes 5 feet deep.			Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.		Undrained Land.			Drained Land.		
												Drained Land.										
Day of the Month.	Per Diem. Inches dec.	Per Acre. (Per Diem.) In Gallons.	Height at the time of recording the Discharge from the Outlets, 8 o'clock, a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	Higher Side.—Distance from Drain to Drain 75 yds. Depth of Drains 7 ft. 6 in.	Lower Side.—Distance from Drain to Drain 33 yds. Depth of Drains 6 ft.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Higher Side. 25 ft. apart and 4 feet deep. No. 31.	Lower Side. 25 ft. apart and 4 feet deep. No. 31	Undrained Land. No. 33.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Of Air 9 inches above surface. No. 33.	Of Soil 18 inches below ground. No. 33.	Of Soil 42 inches below ground. No. 33.	Of Air 9 inches above surface. No. 31.	Of Soil 18 inches below ground. No. 31.	Of Soil 42 inches below ground. No. 31.
1	...	...	30·49	4 2	5 6½	4½	405	3¾	300	3	180	3 9	3 11	1 6	2¼	110	35	37	39	36	40	41
2	...	...	30·48	4 2½	5 6½	4½	405	3¾	300	3	180	3 9	3 11	1 6	2¼	110	43	37	39	44	40	41
3	...	...	30·39	4 2½	5 6½	4½	405	3¼	250	3	180	3 9	4 0	1 6	2¼	110	43	38	40	44	41	42
4	...	...	30·08	4 3	5 6½	4½	405	3	240	3	180	3 9½	4 0	1 6	2¼	110	44	38	40	43	41	42
5	...	...	30·28	4 3½	5 6½	4½	405	2¾	210	3	180	3 9½	4 0	1 6	2¼	110	24	38	40	25	41	42
6	...	...	30·00	4 4	5 6½	5¼	472½	3¾	300	4½	270	3 9½	4 0	1 6	3	150	45	38	40	45	41	42
7	...	...	29·85	4 4½	5 6½	5¼	472½	3¾	300	4½	270	3 9½	4 0	1 6	3	150	34	38	40	34	41	42
8	...	...	29·49	4 5	5 6½	5	450	3¾	300	4½	270	3 9½	4 0	1 6	3	150	47	38	40	46	41	42
9	·030	675	29·66	4 5	5 7	4½	405	2⅝	210	4½	270	3 10	4 0	1 6	3	150	38	37	40	39	40	42
10	·050	1,130	29·90	4 6	5 7	4½	405	3	240	5¼	315	3 10	4 0	1 6	3¾	190	27	36	39	28	39	41
11	·065	1,470	29·80	4 7	5 7	5¼	472½	3½	280	6	360	3 10	4 0	1 6	4½	225	31	36	39	32	38	41
12	...	...	29·89	4 8	5 7	5½	472½	4½	360	6	360	3 10	4 0	1 6	4½	225	32	36	39	32	38	41
13	...	...	29·79	4 9	5 7	5¼	472½	4½	360	5¼	315	3 10	4 0	1 6	3¾	190	31	36	39	31	38	41
14	·060	1,360	29·00	4 9½	5 7	5¼	472½	5¼	420	5¼	315	3 10	4 0	1 6	3¾	190	42	36	40	42	39	41
15	·033	746	29·25	4 9½	5 7	5	450	4½	360	4	240	3 10	4 0	1 6	3	150	43	37	40	44	40	41
16	...	...	29·79	4 10	5 7	3	270	3¾	300	3	180	3 10	4 0	1 6	2¼	112	37	38	40	37	40	41
17	...	...	29·80	4 11	5 7	2¼	200	3¾	300	2¼	135	3 10	4 0	1 6	1½	75	42	38	40	42	40	41
18	...	...	29·69	5 0	5 7	1½	135	4¼	180	3	180	3 10	4 0	1 6½	1½	75	46	38	40	46	40	41
19	·040	905	29·79	5 1	5 7	¾	67½	3¾	300	1½	90	3 11½	4 0	1 7	¾	37	49	40	41	48	42	42
20	·100	2,262	29·80	5 1½	5 7	¾	67½	2¼	180	1½	90	3 11½	4 0	1 7½	¾	38	47	41	41	47	43	42
21	...	...	30·00	5 2	5 7	¾	67½	2¼	180	1½	90	4 0	4 9	1 7½	¾	38	36	41	41	37	43	42
22	...	...	29·80	5 2	5 7	¾	67½	2¼	180	1½	90	4 0	4 0	1 7½	¾	38	34	40	41	35	42	42
23	·122	2,760	29·60	5 2½	5 7	1½	135	2¼	180	1½	90	4 0	4 0	1 7	¾	38	33	39	41	31	41	42
24	·010	227	29·59	5 3	5 7	1½	135	2¼	180	2¼	135	4 0	4 0	1 7	1½	75	38	38	41	38	40	42
25	·015	339	29·40	5 3	5 7	1½	135	2¼	180	2¼	135	4 0	4 0	1 7	1½	75	43	38	41	43	40	42
26	·005	113	29·59	5 3	5 7	¾	67½	2¼	180	1½	90	4 0	4 0	1 7	¾	38	38	38	41	38	40	42
27	...	...	29·88	5 3	5 7	¾	67½	2¼	180	1½	90	4 0	4 0	1 7	¾	38	41	39	41	42	41	42
28	...	...	30·00	5 3½	5 7	¾	70	2½	200	1½	90	4 0	4 0	1 7	¾	38	42	40	41	43	42	42
29	·030	678	29·78	5 3	5 6	1	90	2½	200	2	120	4 0	4 0	1 6	1	50	41	40	41	41	42	42
30	·180	4,072	29·28	5 3	5 6	1½	135	3	240	3	180	4 0	4 0	1 5	2¼	112	42	40	42	42	42	43
31	·080	1,810	29·18	5 3	5 6	1½	135	3	240	3	180	3 11½	3 11½	1 4	2¼	113	42	41	42	43	43	43
Total	·820	18,547		Total quantity of water per acre discharged			8,415		7,830		5,850					3,310						
				Remainder unaccounted for			10,132		10,717		12,697					15,237						
				Total Rainfall			18,547		18,547		18,547					18,547						

HINXWORTH DRAINAGE.—REPORT OF THE MONTH OF APRIL, 1857.

Columns 1, 2: RAINFALL.

Column 3: BAROMETER.

Columns 4–7: OCCASIONAL DRAINAGE.—FIELD No. 40. 16 Acres.—Soil, lower Chalk mixed with Clay Gravel, and Sand. Very wet before Draining.
Columns 4, 5: Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes 8 feet deep.
Columns 6, 7: Quantity of Water from Outlet No. 8, which discharges the Drain Water from Field No. 40.

Columns 8, 9: PART OCCASIONAL AND PART WIDE PARALLEL DRAINAGE. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed. Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.

Columns 10, 11: PARALLEL DRAINAGE. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856. Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.

Columns 12–16: CLOSE PARALLEL DRAINAGE. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep.
Columns 12–14: Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Holes 5 feet deep.
Columns 15, 16: Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.

Columns 17–22: TEMPERATURE. At half past Seven, a.m.

Day of the Month.	1. Rainfall. Per Diem. Inches dec.	2. Rainfall. Per Acre. (Per Diem). In Gallons.	3. Barometer. Height at the time of recording the Discharge from the Outlets, 8 o'clock, a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	4. Higher Side.—Distance from Drain to Drain 75 yds. Depth of Drains 7 ft. 6 in.	5. Lower Side.—Distance from Drain to Drain 33 yds. Depth of Drains 6 ft.	6. Per Minute. In Gallons.	7. Per Acre. In Gallons (per diem).	8. Per Minute. In Gallons.	9. Per Acre. In Gallons (per diem).
1	·050	1,131	29·37	5 3	5 6	¾	67	2¼	180
2	...	...	29·15	5 3	5 6	¾	67	2¼	180
3	·015	339	29·48	5 3½	5 6	¾	68	2¼	180
4	·060	1,357	29·67	5 4	5 6	¾	68	2¼	180
5	·460	10,406	29·69	5 6	5 6	3	270	9	720
6	·035	792	29·58	5 8	5 5	3	270	9	720
7	...	...	29·80	5 8	5 5	3	270	6	480
8	...	...	29·89	5 8	5 5	3	270	6	480
9	·005	113	29·58	5 8	5 6	3	270	5¼	420
10	·080	1,810	29·48	5 8	5 6	2¼	200	4½	360
11	·030	678	29·40	5 8	5 6	2¼	200	3¾	300
12	·035	792	29·35	5 8	5 6	3	270	3¾	300
13	·300	6,786	29·87	5 8	5 6	3¾	338	5¼	420
14	·150	3,394	29·20	5 8	5 5½	3	270	8¼	660
15	·005	115	29·46	5 8	5 5½	3	270	6	480
16	...	...	29·65	5 8	5 5½	3	270	5¼	420
17	·005	110	29·83	5 8½	5 6	3	270	4½	360
18	...	...	29·83	5 8½	5 6	3	270	4½	360
19	...	...	29·78	5 8½	5 6½	2½	200	4½	360
20	...	...	30·10	5 8½	5 6½	2¼	200	4½	360
21	...	...	30·18	5 9	5 7	2¼	200	4½	3[illegible]0
22	...	...	30·00	5 8½	5 6	3	270	5¼	420
23	·205	4,650	29·90	5 8	5 5	3	270	5¼	420
24	...	...	30·76	5 9	5 6	3	270	3¾	300
25	...	...	29·69	5 10	5 6	3	270	3¾	300
26	·005	113	29·80	6 10	5 6	2½	225	3	240
27	...	...	30·00	5 10	5 6	2¼	200	3	240
28	...	...	30·03	5 10	5 6	2¼	200	3	240
29	...	...	30·00	5 10	5 6	2¼	200	3	240
30	...	...	30·00	5 10	5 6	2¼	200	3	240
Total	1·440	32,586		Total quantity of water per acre discharged			6,683		10,920
				Remainder unaccounted for			25,903		21,666
				Total Rainfall			32,586		32,586

Day of the Month.	10. Per Minute. In Gallons.	11. Per Acre. In Gallons (per diem).	12. Drained Land. Higher Side. 25 ft. apart and 4 ft. deep. No. 31.	13. Drained Land. Lower Side. 25 ft. apart and 4 feet deep. No. 31.	14. Undrained Land. No. 33.	15. Per Minute. In Gallons.	16. Per Acre. In Gallons (per diem).	17. Undrained Land. Of Air 9 inches above surface. No. 33.	18. Undrained Land. Of Soil 18 inches above ground. No. 33.	19. Undrained Land. Of Soil 42 inches below ground. No. 33.	29. Drained Land. Of Air 9 inches above surface. No. 31.	21. Drained Land. Of Soil 18 inches below ground. No. 31.	22. Drained Land. Of Soil 42 inches below ground, No. 31.
1	1½	90	3 11½	3 11½	1 3	2¼	110	45	41	42	45	43	43
2	1½	90	3 11½	3 11½	1 3	1½	75	46	42	42	49	44	43
3	1½	90	3 11½	3 11½	1 3	1½	75	48	42	42	47	44	43
4	1½	90	4 0	4 0	1 3½	¾	37	47	43	42	48	45	43
5	13½	810	4 0	3 11½	1 3	8¼	410	44	44	43	45	46	44
6	13½	810	4 0	3 11	1 2	8¼	415	42	45	43	46	47	44
7	12	720	4 0	3 11	1 2	7½	375	45	46	43	46	48	44
8	10½	630	4 0	3 11	1 3	6	300	46	46	44	47	48	45
9	7½	450	4 0	3 11	1 4	5¼	265	44	46	44	45	48	45
10	6¾	405	4 0	3 11	1 5	4½	225	45	47	44	44	49	45
11	6	360	4 0	4 0	1 5	3¾	185	44	47	44	45	49	45
12	6	360	4 0	4 0	1 4	4	205	45	46	44	46	48	45
13	8¼	495	4 0	4 0	1 4	5¼	265	42	45	44	42	47	45
14	15	900	4 0	4 0	1 4	11¼	560	37	44	44	37	45	45
15	9	540	4 0	4 0	1 4	5¼	265	41	43	44	41	44	45
16	7½	450	4 0	4 0	1 4	4½	225	43	43	44	43	44	45
17	6	360	4 0	4 0	1 4	4½	225	44	42	44	44	43	45
18	5¼	315	4 0	4 0	1 4	4½	225	46	43	44	46	44	45
19	4½	270	4 0	4 0	1 4	4½	225	43	44	44	43	45	45
20	4½	270	4 0	4 0	1 4	4½	225	42	44	44	42	46	45
21	3¾	225	4 0	4 0	1 4	3¾	185	42	45	44	42	47	45
22	4½	270	4 0	4 0	1 4	3¾	185	40	46	45	40	48	46
23	4½	270	3 11½	4 0	1 3	3¾	185	38	46	45	39	48	46
24	4½	270	3 11	4 0	1 3	3	148	37	46	45	38	48	46
25	3¾	225	3 11½	4 0	1 3	3	148	43	45	45	43	47	46
26	3	180	4 0	4 0	1 3	2¼	110	39	44	45	39	46	46
27	3	180	4 0	4 0	1 3	2¼	110	37	43	45	37	45	46
28	2¼	135	4 0	4 0	1 3	1½	75	38	42	44	38	44	45
29	2¼	135	4 0	4 0	1 3	1½	75	41	42	44	41	44	45
30	2¼	135	4 0	4 0	1 3	1½	75	40	42	44	40	44	45
Total (quantity of water per acre discharged)		10,530					6,188						
Remainder unaccounted for		22,056					26,398						
Total Rainfall		32,586					32,586						

HINXWORTH DRAINAGE.—RECORD OF THE MONTH OF MAY, 1857.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	RAINFALL.		BAROMETER.	OCCASIONAL DRAINAGE.—FIELD No. 40. 16 Acres.—Soil, lower Chalk mixed with Clay, Gravel, and Sand. Very wet before Draining.				PART OCCASIONAL AND PART WIDE PARALLEL DRAINAGE. 18 Acres.—Soil, same as last in part of field, remainder Gault and Gravel mixed.		PARALELL DRAINAGE. Fields 13 and part 14. 24 Acres.—Soil, Gault Clay with Lime infiltrated. Patches and veins of Sand found giving vent to under water which has run through the Summer of 1856.		CLOSE PARALLEL DRAINAGE. Fields Nos. 31, 32, and 33. Nos. 31 and 32 only drained.—29 Acres. No. 33 undrained. Soil, Gault Clay, with Lime infiltrated. Considered very stiff and impenetrable. Drains, 25 feet apart, and 4 feet deep.					TEMPERATURE. At half-past Seven, a.m.					
				Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes which are sunk midway between the occasional Drains. Test Holes 8 feet deep.		Quantity of Water from Outlet No. 8, which discharges the Drain Water from Field, No. 40.		Quantity of Water from Outlet No. 9, which discharges the Drain Water from No. 22. Size of Pipe, five inches. Commenced running October 12.		Quantity of Water from Outlet No. 13, which discharges the Drain Water from Nos. 13 and part 14. Size of Pipe, 5 inches. Has run throughout the year.		Observations on Test Holes, being the depth of free soil from surface of Land to surface of Water in the Holes, which are sunk midway between the Drains. (See also Temperature.) Test Holes 5 feet deep.			Quantity of Water from Outlet No. 15, which discharges the Drain Water from Nos. 31 and 32. Size of Pipe, 7 inches. Commenced running Nov. 27.		Undrained Land.			Drained Land.		
												Drained Land.										
Day of the Month.	Per Diem. Inches dec.	Per Acre. (Per Diem.) In Gallons.	Height at the time of recording the Discharge from the Outlets, 8 o'clock, a.m. *Note.*—It should be observed that the height recorded is simply the height of the mercury at a certain time of day.	Higher Side.—Distance from Drain to Drain 75 yds. Depth of Drains 7 ft. 6 in.	Lower Side.—Distance from Drain to Drain 33 yds. Depth of Drains 6 ft.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Higher Side. 25 ft. apart and 4 ft. deep. No. 31.	Lower Side. 25 ft. apart and 4 ft. deep. No. 31.	Undrained Land. No. 33.	Per Minute. In Gallons.	Per Acre. In Gallons (per diem).	Of Air 9 inches above surface. No. 33.	Of Soil 18 inches below ground. No. 33.	Of Soil 42 inches below ground. No. 33.	Of Air 9 inches above surface. No. 31.	Of Soil 18 inches below ground. No. 31.	Of Soil 42 inches below ground. No. 31.
1	·040	905	30·07	5 10½	5 6	1½	135	3	240	2¼	135	4 0	4 0	1 3½	1½	74	42	42	44	42	44	45
2	·005	113	30·06	5 11	5 6	1½	135	3	240	2¼	135	4 0	4 0	1 4	1½	74	44	43	44	44	45½	45
3	...	...	30·17	5 11	5 6	3	270	3	240	2¼	135	4 0	4 0	1 4	1½	74	43	43	45	43	45½	46
4	...	...	30·18	5 11	5 6	3	270	3	240	2¼	135	4 0	4 0	1 4	1½	74	44	43	45	44	45½	46
5	...	...	30·19	5 11	5 6	3	270	3	240	2¼	135	4 0	4 0	1 4	1½	74	41	44	45	41	46	46
6	·010	226	30·20	5 11	5 6	3	270	3	240	1½	90	4 0	4 0	1 4½	1½	75	38	43	45	39	45	46
7	...	...	30·19	5 11½	5 6½	2¼	200	2¼	180	1½	90	4 0	4 0	1 4½	1½	75	38	43	45	38	45	46
8	...	...	30·05	5 11½	5 6½	2¼	200	2¼	180	1½	90	4 0	4 0	1 5	¾	37	40	43	45	40	45½	46
9	...	...	29·79	6 0	5 6½	2¼	200	2¼	180	1½	90	4 0	4 0	1 5	¾	37	45	44	45	45	46	46
10	...	...	29·68	6 1	5 6½	1½	135	2¼	180	2	120	4 0	4 0	1 5	1	49	44	44	45	44	46	46
11	·150	3,393	29·60	6 1	5 6½	1½	135	2¼	180	2¼	135	4 0	4 0	1 5	1½	75	47	45	45	48	47	46
12	·050	1,131	29·80	6 1	5 6½	1½	135	3	240	2¼	135	4 0	4 0	1 5	1½	75	49	46	45	50	48	46
13	·010	226	30·00	6 1½	5 6½	1½	135	3	240	3	180	4 0	4 0	1 5	1½	75	52	48	45	53	50	46
14	...	...	30·00	6 2	5 7	1½	135	2¼	180	2¼	135	4 0	4 0	1 5½	1½	75	53	49	46	54	51	47
15	...	...	30·01	6 2½	5 7	1½	135	2¼	180	1½	90	4 0	4 0	1 6	2¼	110	56	51	47	56	53	48
16	·055	1,245	30·10	6 3	5 7	1½	135	2¼	180	1½	90	4 0	4 0	1 6	2¼	110	58	52	48	58	55	49
17	...	...	30·09	6 3½	5 7½	1½	135	1½	120	¾	45	4 0	4 0	1 6	2¼	110	58	52	48	58	55	49
18	...	...	30·00	6 3½	5 7½	1½	135	1½	120	1	60	4 0	4 0	1 6	2¼	110	60	51	48	60	54	49
19	...	...	29·95	6 4	5 8	¾	67	1½	120	1	60	4 0	4 0	1 6	2¼	110	63	50	48	63	53	49
20	...	...	29·80	6 4½	5 8½	¼	23	1½	120	¾	45	4 0	4 0	1 6	2¼	110	63	51	48	64	54	50
21	...	...	29·60	6 5	5 9	¼	22	1½	120	¾	45	4 0	4 0	1 6½	2¼	110	65	54	49	65	56	51
22	·040	905	29·76	6 5	5 9½	Nil	Nil	1½	120	¾	45	4 0	4 0	1 6½	2¼	110	66	54	50	66	56	51
23	·170	3,845	29·60	6 6	5 10	Nil	Nil	2	160	1	60	4 0	4 0	1 6	3	148	64	54	50	63	56	51
24	·030	678	29·41	6 6	5 11	1½	135	1½	120	1	60	4 0	4 0	1 6	3½	173	61	54	50	62	56	51
25	...	...	29·46	6 6	6 0	1½	135	1½	120	1	60	4 0	4 0	1 6	3¾	185	60	54	50	61	56	51
26	·180	4,074	29·48	6 6½	6 3	1½	135	1½	120	1½	90	4 0	4 0	1 6	4	198	61	54	49	60	55	51
27	...	...	29·64	6 6½	6 3	1½	135	1½	120	1½	90	4 0	4 0	1 6	4	199	62	53	49	62	55	52
28	...	...	29·70	6 6½	6 4	1	90	1	180	1	60	4 0	4 0	1 6½	3¾	185	62	53	50	61	56	52
29	...	...	29·80	6 7	6 5	1	90	1	80	¾	45	4 0	4 0	1 6½	3¾	185	61	53	50	60	56	52
30	·010	226	29·89	6 7½	6 6	1	90	1	80	¾	45	4 0	4 0	1 7	3	149	62	53	49	62	56	52
31	...	...	29·95	6 8	6 6½	1	90	1	80	¾	45	4 0	4 0	1 7	3½	173	...	...	...	...	...	...
Total	·750	16,967		Total quantity of Water per acre discharged			4,132		5,040		2,775					3,418						
				Remainder unaccounted for			12,835		11,927		14,192					13,549						
				Total Rainfall			16,967		16,967		16,967					16,967						

SUMMARY OF THE FOREGOING RECORDS.

MONTHS.	RAINFALL.		QUANTITIES DISCHARGED FROM OUTLETS.				MONTHS.
	Inches dec.	Per Acre. In Gallons.	From Outlet No. 7, from Oct. 1 to Feb. 28, and from Outlet No. 8 from March 1 to May 31 as per col. 7. Per Acre in galls.	From Outlet No. 9, as per col. 9. Per Acre in galls.	From Outlet No. 13, as per col. 11. Per Acre in galls.	From Outlet No. 15, as per col. 16. Per Acre in galls.	
October	1·645	37,215	12,910	178	8,915	Nil	October.
November	1·630	36,872	27,000	2,077	6,015	330	November.
December	1·235	27,935	30,565	11,895	15,935	5,825	December.
January	2·333	52,775	43,855	39,090	49,250	31,805	January.
February	·192	4,343	27,360	14,320	13,650	9,060	February.
March	·820	18,547	From Outlet No. 8, at a higher level { 8,415	7,830	5,850	3,310	March.
April	1·440	32,586	6,683	10,920	10,530	6,188	April.
May	·750	16,967	4,132	5,040	2,775	3,418	May.
Total Rainfall	10·045	227,240	160,920	91,350	112,920	59,936	Total discharge per Acre.
Difference between Rainfall and Discharge from the Drains ...			66,320	135,890	114,320	167,384	
			227,240	227,240	227,240	227,240	Total Rainfall.

The object I had in conducting the experiments and in tabulating the results now collected, was first, to gain tangible and irresistible proof of the draining capabilities of clay soils, and next, to demonstrate to what extent the close parallel system of drainage, so necessary for the drainage of clays, may be profitably departed from in soils of an open and irregular character by the adoption of occasional deeper drains. I selected the clay lands of Hinxworth, because they presented a surface and subsoil, and had a local reputation as forbidding as any clay lands I had visited in my practice as a draining engineer, and because the open and mixed soils were from their position exceedingly wet and cold at that season of the year—from February to May—when a free and warm bed is most required by vegetation.

In 1849, when I reported on the drainage of the Hinxworth Estate, I advised the owner, Mr. Clutterbuck, of Watford-house (who then contemplated some partial work), not to attempt the drainage in any other way than as a whole, because I considered that nearly every part was more or less dependent on adjacent lands, and that the work would only be satisfactory and complete when effected altogether, and by a connected scheme of operations. This suggestion Mr. Clutterbuck acted upon, and when the estate is viewed geologically in its relation to the surrounding district, and the several parts of the estate considered in relation to each other, I believe the value of the decision to deal with it as a whole will be fully appreciated.

In the winter of 1855-6, Mr. Clutterbuck determined to drain the whole estate. It consists of three farms, containing together about 800 acres. It lies at the base of the chalk escarpment of the London Basin, and covers a portion of the lowest bed of the chalk, the outcrop of the greensand, and a portion of the gault of the greensand formation. In several parts a superficial deposit of drifted gravel and sand overlies the older beds. The greensand separating the chalk from the gault is very thin, and, if collected in a distinct layer, would not exceed three inches in depth in its thickest part. The gault has gained a siliceous character where it comes immediately in contact with the greensand. It has also imbibed a calcareous quality by an infiltration of the chalk through the greensand into its bed; for a wide breadth, however, the gault is denuded, and there, although the greensand is absent, a very considerable infiltration of lime has taken place, which, I presume, may be accounted for by the fact, that the chalk escarpment rises in almost cliff-like shape immediately at the margin of the gault, and any submersion of the gault has necessarily imparted to it the character of its more prominent and overwhelming neighbour.

The following are several analyses of Professor Way:—

Of the Lower Chalk and Mixed Drift.

Moisture and organic matter	3·27
Sands and clays	24·37
Silica soluble in acids	1·23
Oxide of iron	1·14
Phosphate of lime	0·92
Sulphate of lime	0·76
Carbonate of lime	68·31
	100·0

Of the Gault (at 24 inches deep.)

Moisture and organic matter	5.01
Sands	0·66
Clay	63·26
Carbonate of lime	31·07
	100·0

Of the Gault (at 42 inches deep.)

Moisture and organic matter	4·28
Sands	0·34
Clay	62·97
Carbonate of lime	32·41
	100·0

The whole of the lands, both those of the mixed open character and those of the gault clay, suffered greatly from excessive wetness before drainage; the water in each standing within a few inches of the surface during the spring months of March, April, and May. A connected system of works was adopted. The chalk and mixed drift soils were drained by occasional and wide parallel drains (from 4 to 8 feet deep), sufficient to discharge the rainfall and relieve the pressure of subterranean water passing through the soil from the higher grounds to their natural outfalls, at a cost varying from £1 10s. to £3 10s. per acre. The gault clay soils were drained uniformly by a parallel arrangement of drains 25 and 27 feet apart, 4 feet deep, at a cost varying from £5 10s. to £6 10s. per acre. The effect of the different modes of draining in lowering the water-level in each description of soil, is shown by the height of the water standing in the test-holes as set forth in columns 4, 5, 12, and 13. The discharge from the several outlets following rain is exhibited by columns 7, 9, 11, and 16. It will be observed that the discharge from the open soils was much more regular than from the clays, while the latter gave out a very large proportion of heavy rainfalls immediately after they occurred. A remarkable proof of the influence and penetration of atmospheric changes through soil to the depth of drains is to be seen in the fact, that all the outlets discharged an increased quantity of water on the 6th of March and 22nd of April, without any fall of rain on the surface, it being observed on each occasion that a very considerable fall of the barometer had taken place within the previous twenty-four hours.

DISCUSSION.

The Rev. J. Clutterbuck agreed with Mr. Denton as to the importance of correct records of meteorological phenomena. This principle, with regard to the measurement of rainfall, had been recognised and carried out by his grandfather, a hundred years ago. What he, Mr. Clutterbuck, considered the perfection of the registration of rainfall had been attained by means of photography. Mr. Clutterbuck proceeded to give a description of the way in which this was effected by the photographic apparatus, as employed at the Observatory at Oxford. The observations were continued day and night. The most accurate register of rainfall, as well as of the action of the wind, was by this means obtained; even the exact moment at which a shower fell was recorded. He had not unfrequently been asked what was the practical utility of keeping records of rainfall. In many cases there were absolute and tangible benefits resulting from it, and he could mention instances in which most important public works had been regulated solely by the register of the rainfall; and his friend, Mr. Dickinson, who used a rain-guage of a peculiar construction, stated some time back that he regulated his contracts for working his mills by the rain guage. In such cases, therefore, there were tangible practical benefits resulting from keeping a record of the rainfalls. With regard to floods, particularly in the river Thames, he had noticed that the amount of flood water depended upon the direction of the wind at the time of the rainfall, and the effect of this was, that when there was rain with an easterly wind no excessive flood took place. That was especially the case when the almost unexampled fall of rain took place in the month of October last. Living on the banks of the Thames below Oxford, he was then able to predict that although the rain fell in such large quantities, no serious flood would ensue, because it was an easterly rain, but if that rain had come from the west there would have been a heavy flood. He had observed that under one-third of an inch of rainfall hardly told upon the floods of the Thames. He considered that unless they had a complete system of rain guages, those who had the regulation of flood-gates could not properly perform their duty, because, if the flood-gates were drawn at one place too soon, the water was sent away too quickly, whilst, on the other hand, restraining the water too long, flooded the district above. In the supply of water to towns generally, attention to the rainfall was an indispensable condition. He thought that in the present scientific age such a paper as this ought not to be called for, inasmuch as the advantages of a correct register of the rainfull of the country should have been recognised and acted upon many years ago, and unless they availed themselves of the manifest appliances of science in promoting the social economy of the country, the next generation might justly reproach them for their culpable neglect.

Mr. C. Greaves felt indebted to Mr. Denton for his paper, and agreed with him as to the importance of a correct record of the rainfall. There was no doubt the register should be general and well tabulated, and that the work should be carried on by those who understood it, and instruments of the best description employed for the purpose. Without offering any opinion as to whether the £26,000 per annum should be sanctioned by government, he thought Mr. Denton had overrated the requirements of the case, inasmuch as at the present time a very large number of records of rainfall were kept, although they were obtained without any special commission, and the amount of information they had on the subject was really considerable. The summary of the Meteorological Society was extremely well done, and was reduced from a very large number of obeservations. There was nothing that this country was so likely to fall short of as water, for the supply of which we were dependent entirely upon our own island, and the necessity of storing and preserving it had during several years past become a matter of increasing interest. The moors were being laid under tribute. Reservoirs were constructed for the retention of water for mill power, as well as for supply of water for domestic purposes. He thought in measuring the quantity of rain that fell they only dealt with half the question. The quantity that came down was a great matter, but that which passed away in evaporation was of equal and perhaps of more importance. It was unfortunate that so many persons had established rain-guages without also providing some system of registering the quantity of water evaporated, whether from the surface of the water or the surface of the ground. This being a question of considerable interest to himself, he had made some experiments with a couple of rain-guages—a surface guage and a ground guage. Acting upon the notion that the larger they were the better, he constructed them a yard square. He placed them side by side, one of them being filled with a cube yard of earth, with grass upon the top. Attached to the bottom was a glass tube, similar to that placed within the open rain guage. The register of these two guages went on simultaneously, and the results were very fairly comparable one with the other. The result he found was, that only one-fifth of the rain that fell reached to the bottom of what he called his ground guage; and the conclusion he arrived at was, that if water went down a yard deep, or even 2 feet, it was beyond the limits of evaporation. Therefore he assumed that one-fifth only of the rain-fall went down to the springs; he considered that the registration of the rain-fall should be carried on daily. In calculating the comparative evaporation in different months and quarters of the year, he observed that not a drop of rain went down to the ground-guage during the six summer and autumn months, let it rain ever so hard. Therefore, all the water that went down to the springs did so between the months of October and March; and, taking the quantity at 5 inches, there would be 3 inches during Oct. Nov. and Dec., and 2 inches during Jan. Feb. and March. There could be no doubt that the degree of cold in this country was much affected by the amount of evaporation that was constantly going on. The evaporation of moisture from the sur-

face was the great reducer of the temperature; and therefore, for the sake of elevating the temperature, as much as for any other object, drainage had become essential, and was, on those grounds, recommended; and the practical results had shown how much the temperature had been raised by that means.

Mr. DE LA TREHONNAIS remarked, that Mr. Denton had stated that an accurate knowledge of the rainfall was not only useful, but actually necessary for the proper drainage of the land; but during a storm an immense quantity of water might fall, and that contingency must be kept in view in drainage, in order to allow the superabundance of water to run out of the land. In his own opinion the average of rainfall had not so much to do in the way of drainage as some people seemed to imagine, because drains must be laid in such a manner as to give an outlet for the immense body of water that might come suddenly upon the land. It had been stated that water at the depth of two feet was beyond the reach of evaporation. For his own part, in his fields, he should not like the water-bearing stratum to be less than 3½ feet down, otherwise he should be in fear that the temperature of the soil would be greatly lowered.

Mr. THOMAS WEBSTER, F.R.S., said, he thought the last speaker had pointed out the real question for consideration. He (Mr. Webster) did not regard it of so much importance to know precisely the quantity of rain that fell at each place, and the observations already made were very numerous, and might, he thought, be considered sufficient. In the valuable tables published by Mr. Beardmore, there was included the record of the quantity of rain which fell in almost every place in England. Professor Lloyd had also published extensive observations in Ireland, obtained from persons employed in the coastguard service, and in those the east coast, compared with the west, gave results similar to the observations made in England. In the consideration of this question, regard must be had to the character of the district—first, as to level; secondly, as to situation—whether east or west; thirdly, inclination; and fourthly, the nature of the strata. He apprehended, if those facts were given, knowing the amount of rainfall, they could tell what would be the amount of outfall they must provide for artificial drainage. These were practical questions belonging to the agricultural engineer, and could only be solved by those who had a knowledge of the various localities. Therefore, he thought the establishment of observations by paid observers was hardly worth the expense, for, as regarded the general laws of the distribution of rain, the quantity was ascertained within two or three inches, but how it was to be dealt with was so much a matter for individual localities, that they must look to those interested in the question to deal with it. The remark of Mr. Greaves was a most important one, viz., that only one-fifth of the rainfall went to feed the springs, and that four-fifths went off by evaporation. He had often considered how an accurate test of evaporation might be obtained, and he thought the notion of the cube yard of earth was an extremely valuable one. With regard to rain guages, he recollected that when Professor Lloyd read a paper on the subject before the British Association at Belfast, some advocated a spherical rain guage, as it was argued that by this means whichever way the wind blew the entire rainfall was registered. A comparison of the various guages might, however, be easily made. With regard to the easterly and westerly rains mentioned by Mr. Clutterbuck, the rain during a dry east wind was due almost entirely to the condensation consequent upon the cold and dry wind coming from the North Pole. Therefore, when they had a fall of rain with an easterly wind, the quantity absorbed by evaporation was enormous as compared with that evaporated during a westerly wind. This would account for the difference in the amount of floods which had been mentioned.

Mr. ROBERT RAWLINSON said that civil engineers fully recognised the use of the rain-guage, and he (Mr. Rawlinson) agreed with Mr. Webster in thinking Mr. Denton had rather underrated the value of existing records as to rainfall, returns having been published which were easily accessible for England, Scotland, and Ireland. To establish a national system of rain-guagings must be very costly, and the results would only be useful to a limited extent. A national survey was useful, but it would not prevent the necessity for special surveys for special purposes. No nation could do the work of individuals, nor ever would do such work. With respect to the fall of rain, as connected with town sewerage and land drainage, registration of volume was only useful to a limited extent. No engineer could deal with maximums, as the excesses could not be reserved in either sewers or drains, but must pass away in a natural manner over the surface. From careful registration and from tolerably accurate guagings of volume at outfalls, in one case over an area of steep mountain district rising more than a thousand feet, and in a second case from a tolerably flat and porous soil and subsoil, it was found that the maximums in both cases were almost identical, and that these maximums, as compared with the minimum flow, reached almost every year as high as 300 to 1, and occasionally even to 400 for short intervals; that is, a natural stream having one gallon per minute flowing down during a continuance of dry weather, had, in its annual floods, three hundred gallons in a similar time; and, at longer intervals, even up to four hundred gallons. This, he believed, would be found, more or less, to be the case throughout Great Britain, whether the annual rainfall was 20 inches or 40 inches—as the district of least annual fall might have thunderstorms of short duration, but heavier than any which took place in a locality were the rain fell in a greater number of days. The engineer should pay especial attention to excesses of rain and to flood outfalls, and he would find that he could not deal with such vast volumes of water either in sewers or in drains. The Ouse at York, and the Eden at Carlisle, had each a flood rise upwards of 20 feet in vertical height, and vast areas of valley land were covered at such times. Then, as to the work sewers and drains had to do, the subsoil water must be taken into account, and this would be found greater than was generally imagined. The contemplated low level intercepting sewers for metropolitan sewerage, if ever made, would, in his opinion, actually be filled permanently with subsoil or spring water. Rivers were the natural drains of a country, both for surface and for subsoil. The banks of the Thames were full of springs, and much of the subsoil was quicksand. Brick sewers would admit the water, and not unfrequently the fine sand. The mischief and danger of large and deep sewers in such strata, could hardly be overrated. The excessive volume of spring water would remain to be pumped, where there was no natural outlet—that is, below ordinary low water. In several towns in which public sewers had been carried out, the flow, during dry seasons, had been guaged, and the excesses of surface and of subsoil-water found in the sewers at such times were, in one case, five to one, and, in a second case, nine to one —that is, the sewage due to water supply was taken as one, and the subsoil-water and surface-water, at the driest times, five and nine. In both these cases there was a natural outfall. At Worthing, where the whole of the sewage and subsoil-water had to be pumped, the excess of subsoil-water was even greater. English engineers were now engaged in all parts of the world, and a knowledge of the laws of nature was indispensable to prevent fatal blunders. If, in Great Britain, maximums of floods up to 400 should be provided for, in the tropics maximums of thousands must be anticipated. There were natural phenomena to be observed, which might teach the engineer at a glance what he ought to expect, such as dry ravines, full of the evidences of water; the bare sides of mountains, and the absence or presence of

peculiar vegetation; the one destroyed or swept off by floods of water, the other produced by such floods. In all cases the engineer must guard, above ground, against maximums, and, as far as is possible, ascertain what these were likely to be, and then work on the safe side. In all cases the rain-guage should be consulted for minutiæ and for details; but for maximums, such as land-floods, valley outfalls of streams and rivers must be guaged.

The CHAIRMAN said he was quite sure that all present would agree with him in considering the Society to be much indebted to Mr. Denton for having brought this subject under consideration. It had been treated by Mr. Denton chiefly with reference to drainage, a subject with which he was specially conversant, and he had also made some allusions to other and more general purposes, for which an accurate register of the rainfall in Great Britain would be valuable. He (the chairman) however, could not close the meeting without observing that he thought the plan of having a register kept at every five or ten miles was not required by the circumstances of the case, and he thought the reasons for this had been clearly stated by several gentlemen who had taken part in the discussion. He considered that every one must feel that, though it was extremely desirable to have extensive and correct information on the subject of the rainfall, yet they must not, as a Society, endeavour to aim at any object in a way that might appear to be merely theoretical, or to be attended with too much refinement, or involving an amount of public expenditure which there was no chance whatever of the government—at least for some length of time—being likely to sanction. He did not think that the government would be willing to appropriate £26,000 a year merely for the purpose of obtaining correct registers of the rainfall throughout the country; and looking, as he had recently done, with much attention at the existing state of information, he found that a vast quantity of detail was available for publication in the ordinary proceedings of Meteorological and other Societies, and by individuals taking an active interest in the subject. He had looked over records kept by Mr. Glaisher, extending back over a long period of years, and derived from accurate observations made throughout the kingdom, and although additions might, and he hoped would be made, yet practically, he thought that nearly all was attained that was of direct value in a public point of view. As to special cases, requiring detailed attention, these must be separately dealt with. He held in his hand a map prepared by Mr. Denton, which purported to show the different places where registers of rainfall were kept, and in examining this map he first looked at the district with which he was best acquainted, and he found that two places, where registers were kept under his own superintendence, were omitted. In these places very accurate observations had been made, and, in one case, previously to his taking up the record, a meteorological register had been kept by the Rev. William Walton for a period of about thirty years. It had been very correctly observed, by more than one of the gentlemen who had spoken, that as regarded drainage, it was not any nicety of calculation that was required as regarded the mean rain-fall, it was the maximum that must be provided for, and not only so, but a liberal margin as well. But in order to know the maximum in different districts a correct register was necessary, so that due preparation might be made for extraordinary falls, and in this again the element time was important, as a daily register alone would not convey an idea of the quantity of water for which it might be necessary to provide the means of removal. In the district to which he had made allusion, he had witnessed a fall of rain of 2·84 inches in less than four hours. That was an extraordinary amount of rainfall, and it was indispensable for the safety of houses and other property that proper outlets should be provided, but unless careful observations were extended over a long term of years it would not be possible to adopt measures of prudence without incurring unnecessary risk or an undue expenditure. But there was another and very important phase in which the subject of Mr. Denton's paper might be viewed, and that was the great value of an accurate knowledge of the amount of water available for power to be applied to engineering or mechanical purposes. He did not now wish to raise a question foreign to the subject immediately before them, as regarded the existing quantity or probable duration of coal, but supposing that, either in particular districts or generally, the expense of procuring coal was increased, or any falling off in the supply occurred, it would then be desirable to use a cheaper source of power, and such a source of power in almost immeasurable abundance was capable of being applied by the use of streams, which were now considered as comparatively valueless. He regretted that the lateness of the hour prevented his going into details, but he would very briefly observe that in one of the mining districts under his direction the mountain streams were collected into reservoirs, and directed by means of water races or pipes, so as to act on all the various kinds of engineering or mechanical work required, and a power equal to more than five hundred horses was thus available, and was now either in operation, or in full progress towards completion. The mere power of a stream of water might not suffice for the required objects, but by employing a wheel constantly in one direction, forcing pumps were worked so as to be at all times raising water into the interior of a cylinder, where it was subject to a pressure from a vertical piston loaded to the weight of 40 or 50 tons. The water which was thus being constantly—day and night—stored up in this magazine of power, remained there subject to the enormous pressure which had been gradually overcome; it was accumulated as a store to be used in three, four, six, or ten hours, as the case might be, and the apparatus, which was the patented invention of Mr. W. G. Armstrong, of Newcastle, was called an *accumulator*. He could speak most strongly as to the simplicity and value of this arrangement, by which it was obvious that wherever circumstances were favourable for the collection of streams at an elevation of even a few feet, the hitherto neglected power of such streams might be made available to a much greater extent than they could possibly have been under the system of water wheels alone. This subject, he believed, for the reasons to which he had alluded, to be of more importance than was commonly supposed, and he need scarcely observe how valuable for such purposes would be any information as to the amount of rainfall and evaporation, as also of the maximum and minimum quantity of water in streams and rivers. Another point, and a very interesting one, had been adverted to, viz., the best form of rain-guage to be employed. He could not now go into the details of that question, but it was a subject worthy of great attention, and any information on which could not be too highly prized. He met with anomalies for which he could not account, and he trusted that the Institutions throughout the country would take up this inquiry in their respective localities. Indeed, he hoped that the numerous and very interesting facts and observations to which Mr. Denton had called their attention, would create and extend a taste for meteorological observation, and thus be a means of providing records in such parts of Great Britain as were so far inadequately represented. He had much pleasure in saying that the Institution of Civil Engineers, appreciating the practical value and importance of such knowledge, had liberally placed the meeting room of that Institution at the service of the Meteorological Society for its meetings, which would admit of their being more numerously attended than they had hitherto been. Mr. Denton, in his paper, had aimed at a very large system of methodical registration, and although he (the chairman) felt that the time had not yet arrived for such large requirements to be met by the government of this

country, yet the consideration of the subject by this Society, and the valuable observations offered during the present discussion, would tend to arouse the attention of agriculturists, engineers, and of the public generally, and lead us, he hoped, to the further perfecting of the arrangements now pursued by the Meteorological Societies and others. He begged to propose a vote of thanks to Mr. Denton for his extremely interesting and valuable paper.

A vote of thanks was then passed to Mr. Denton.

Mr. Denton, having acknowledged the compliment, said—In the first place he would state that the omissions in the plan alluded to by the chairman were entirely owing to the fact that he could not find those places on the map, and could not obtain sufficient information to enable him to put them upon the plan with authority. The map showed, by dots, every station in England recognised as authoritative, which amounted to 120 stations, and these, he submitted, were as nothing compared with the number they ought to have. The evaporation from land must depend upon whether there was a vent below, that acted as a means of discharge, by which the water might flow out of the soil as soon as it got into it. If drains existed below, they removed a large quantity of the rain as it fell, and by that means diminished, if not entirely prevented, evaporation. If there was no drainage below, the soil was kept in a saturated state until evaporation released the water. Therefore, to arrive at a result, without taking into consideration both these circumstances, was not fair reasoning. Some questions were asked as to the depth and distance to which drains should be dug under varying circumstances of rainfall. He (Mr. Denton) had already stated that they had before them this glaring fact, that upon soils of precisely the same mechanical and geological formation—take, for instance, the lias, running from north to south,—in some places they had 37 inches and in others 21 inches, and the number of days of rain would vary considerably. He would put it to those present whether that fact must not have a direct influence upon the drainage of the land—a difference of 16 inches in the rainfall, or equal to the entire rainfall of Essex; and it was opposed to all reason to suppose that so great a difference as 1,600 tons of water falling on the surface should not have a considerable effect. It could not be right to treat the two instances in the same way.

The Secretary announced that on Wednesday evening next, the 20th inst., a paper by Mr. William Clay, "On the Manufacture of Puddled and Wrought Steel, with an Account of some of the Uses to which it has been Applied," would be read.

SOUTH KENSINGTON MUSEUM.

During the week ending 9th January, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,439; on Monday, and Tuesday, (free evenings), 2,528. On the three students' days (admission to the public 6d.), 635. One students' evening, Wednesday, 85. Total, 6,687.

Home Correspondence.

MR. UNDERWOOD'S PAPER ON INK.

Sir,—May I be permitted to make a few remarks on Mr. Underwood's paper on inks. Having had considerable experience in this manufacture, I am well acquainted with its peculiar difficulties. From my numerous experiments, I feel convinced that it is not from any solution of logwood that an advance and improvement in the manufacture of ink can be made. Logwood, and extract of logwood, has long been used, in all proportions, with gall nuts, metallic iron, and iron salts. The more logwood, the commoner and cheaper the ink, such as school ink, &c. Now, how a patent can be claimed for any such combination in any proportion whatever, I cannot conceive. The principal feature of Mr. Underwood's paper, viz., the use of "chromate of potassa," your correspondent Mr. B. Winstone has justly observed was invented by Professor Runge. The recipe, just as Mr. Winstone has quoted it, was copied into all the cheap journals of the day, viz., some four or five years ago, and recommended as a very cheap ink for steel pens. A German got hold of it, and went about London among the stationers selling the recipe; many were victimised, as the product was worthless. I have some writing in my possession with this ink, carefully prepared, and it has quite faded, as might be expected. He also stated that he saturated copying paper with the chromate salt, and wrote with logwood solution. In the discussion which took place, Mr. May justly questioned the durability of any compound of logwood. Mr. Deputy Lott seemed to think if its indelible character could be proved, it would be valuable to the legal profession. No doubt an indelible ink would be, but certainly any logwood ink would be dangerous to rely upon. The only real scientific advance in this manufacture was made by the celebrated chemist Berzelius, from the rare metal "Vanadium;" this is, unfortunately, so scarce as to preclude its use for this purpose. It was stated to be indelible. The chemical action of chromate of potassa upon solutions of logwood, is an oxidising one. The colouring principle of this wood was first extracted and investigated by Chevreul, the French chemist; it is termed "Hematoxylin," and deposits in brownish-yellow prismatic crystals. By contact with air or oxidising agents, it is converted into "Hematin," which is granular and of a purplish black hue, and this is what is produced on the copying paper saturated with the chromate salt, when placed in contact with logwood ink. Very common inks are made with large proportions of logwood, or extract of logwood, from the fact of their being produced at about 4d. per gallon—very small quantities of iron salts being requisite. The chromate ink of Runge is still cheaper. I am now engaged with experiments on indelible ink, and trust some future day to lay the results before the Society, as the subject is one of some importance.

I am, &c.,

ROBERT PINKNEY.

18, Bread street Hill, E.C., Jan. 11, 1858.

Proceedings of Institutions.

Crosby-hall.—Evening Classes for Young Men.—On the 7th Jan. a lecture was given by S. C. Hall, Esq., F.S.A., Editor of the *Art Journal*, and the author (with Mrs. S. C. Hall) of "Ireland: its Scenery and Character." The subject of the lecture was "The Fairy Legends of Ireland." The purpose of the lecturer was to amuse rather than instruct, although his lecture contained much information concerning Ireland, and especially those local peculiarities which are rapidly fading away before the advance of education. The fairy legends of that country are now to be found only in books, or in the memories of those who gathered them long ago; so it is, indeed, although to a less limited extent, with the almost proverbial wit and humour of the Irish peasantry. The lecture was enlivened by many illustrative and characteristic anecdotes. The following is the syllabus of the lecture:—"Universality of faith in Fairies—The essentially poetical character of Irish Fairies—Their meeting places, &c.—Fairy changelings—The Phooka—the fiend spirit of the Morass—The

story of Daniel O'Rourke and the Aigle. The Banshee. The White Lady of Sorrow. The Cleuricaune—The Irish treasure-keeper. The Dullahaun—Spirits without heads—Perils of Ned Sheehy—The Thierna-naoge—The land of perpetual youth—Stories of Ossian's white cows, and the holy monk of Aghadoe. The Hy-Brasil—The Isles of the blest. The Merrow—the Irish Mermaid—Story of John of the Glyn. Monastic Legends—Glendalough—How St. Kevin got rid of the last of the Serpents. Illustrative Anecdotes of the humour and pathos of the Irish character—Irish Bulls—Irish Brogue—Irish Beggars, Waiters, Car Drivers, &c.—The ever-ready wit of the Irish peasantry. Summary of the high capabilities for good of the Irish people. Impressions of the lecturer regarding Ireland as resulting from frequent visits, and from journeys through many of the highways and by-ways of the country."

BIRMINGHAM.—On Monday evening the 11th inst., a lecture was delivered at the Midland Institute, by the Rev. C. P. Wilbraham, a friend of the President, Lord Hatherton. Having seen a good deal of the world, chiefly while an officer in the army, the reverend gentleman entertained a numerous audience for nearly two hours, as he told of his "adventures in four quarters of the globe." The lecture was a pleasant bit of instructive gossip.

MEETINGS FOR THE ENSUING WEEK.

TUES. Royal Inst., 3. Prof. Huxley, "On Vital Phenomena."
Civil Engineers, 8. Discussion upon Mons. Guérin's Paper "On Railway Brakes," and Mr. T. S. Sawyer, "On self-acting Tools for the Manufacture of Engines and Boilers."
Pathological, 8.
Statistical, 8. Col. Sykes, M.P., "On Public Works in India."

WED. Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. William Clay, of the Mersey Steel and Ironworks, Liverpool, "On the Manufacture of Puddled and Wrought Steel, with an Account of some of the Uses to which it has been applied."
Geological, 8. I. Dr. C. Daubeny, "On the Emanation of Ammonia from Volcanoes." II. Rev. Prof. S. Haughton, "On some of the Granites of Ireland." III. Dr. J. J. Bigsby, "On the Classification and Stratigraphy of the Palæozoic Rocks of the State of New York."

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat, considered as a mode of Motion."
Philosophical Club, 5½.
Antiquaries, 8.
Chemical, 8. I. Dr. Gladstone, "On the Mutual Reaction of Salts in Solution." II. Dr. Noad, "On the Chemical Differences of hot and cold Blast Iron." III. Dr. Bird Herapath, "On the Iodo-sulphates of the Cinchona Alkaloids."
Linnæan, 8. Prof. Huxley, "Memoir on the Organic Reproduction of *Aphides*."
Philological, 8.
Royal, 8½.

FRI. Royal Inst., 8½. Prof. Tyndall, "On some Physical Properties of Ice."

SAT. Royal Inst., 3. Mr. Bloxam, "On the Chemistry of the Air."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Jan.* 8, 1858.]

Dated 5th November, 1857.

2806. Godwin Ratler Simpson and David Caldow Simpson, No. 78, High-street, Whitechapel, and No. 5, George-terrace, Commercial-road—Improvements in spring blinds.

Dated 19th November, 1857.

2906. Philip Edward Coffey, Bromley, Middlesex—An improvement in the process of distilling.

Dated 16th December, 1857.

3088. James Thornton, Nottingham—Improvements in apparatus used for the manufacture of carpets and other cut pile fabrics.

Dated 18th December, 1857.

3114. Robert Oxland, Plymouth—Improvements in the manufacture of alloys or compounds containing metallic tungsten. (A communication.)

Dated 19th December, 1857.

3116. Asa Lees and John Clegg, Soho Iron-works, Greenacres Moor, near Oldham, Lancaster—Certain improvements in looms for weaving.

3118. Richard Furnival, Manchester—Certain improvements in machinery or apparatus for cutting paper, cardboard, and other similar articles.

3120. Richard Archibald Brooman, 166, Fleet-street—Improvements in signalling, in order to prevent collisions between trains upon railways. (A communication.)

3122. John Bartlett, Bristol—An improvement in weighing machines.

Dated 21st December, 1857.

3128. James Hamilton, Liverpool—Improvements in ship building.

3130. Robert Rennie, Netherwood, Dumbarton—Improvements in self-acting trap doors for mines.

3134. James Tatlow and Henry Hodgkinson, Wirksworth, Derby—Improvements in railway breaks, and in apparatuses for connecting shafts or rods for working breaks and signals.

3135. William Basford, No. 15, Lowther-cottages, Liverpool-road, Islington—Improvements in the manufacture of gas, and in retorts and other apparatus to be used therein.

3138. Richard Ford Sturges, Birmingham—A new or improved manufacture of rollers or cylinders for printing fabrics.

Dated 22nd December, 1857.

3140. Samuel Rodgett and Daniel Rodgett, Blackburn—An improved method of coupling and uncoupling railway, tramway, and other carriages, waggons, lorries, trucks, and other vehicles.

3142. Morris Landou, 25, Pudding-lane—Improvements in cooking utensils.

3144. Edwin Maw, Doncaster Iron-works, Yorkshire—Improvements in ornamenting and strengthening metal tubes and rods with wood, applicable in the manufacture of bedsteads and other articles of furniture and framings, and also in the manufacture of the joints or connections of the posts and framings of bedsteads and other articles of furniture and frames.

Dated 23rd December, 1857.

3150. Augustus Frederick Kynaston, R.N., Plymouth—An improved slip or disengaging hook.

3152. John Murray, Whitehall-place—Improvements in propelling ships and vessels. (A communication.)

3154. Alexander William Williamson, 16, Provost-road, Haverstock-hill—Improvements in treating scammony root and commercial scammony, to obtain the active principle therefrom.

WEEKLY LIST OF PATENTS SEALED.

January 8th.

892. Wm. Edmondson Jones.
893. John Talbot Pitman.
895. Thomas Frederick Henley.
935. François Burot.
940. Murdoch McKay and Henry Forfar Osman.
962. William Henry Gauntlett.
2006. Joseph Conway.
2010. Frederick Warner.
2032. William Johnson.
2046. George Tomlinson Bousfield.
2052. Octavius Henry Smith.
2104. John Elce and John Leech.
2160. George Tomlinson Bousfield.
2274. George Tomlinson Bousfield.
2616. Thomas Bell.
2682. Frances Windhausen.
2776. Joseph Fry.

January 12th.

1941. Henry Starr.
1943. Nicholas Williams and Thomas Williams.
1054. Henry Hebblethwaite, William Shuttleworth, and William Tasker.
1956. Wm. Stettinius Clark,
1959. Gustavus Palmer Harding.
1963. François Moulin.
1964. William John Locke.
1972. Wright Jones.
1973. James Wright.
1974. John Cox.
1977. George Samuel Mathews.
1985. Thomas Clunes and John Mackintosh.
1988. Thomas Roberts and John Dale.
2005. Henry Vennor Cowham.
2017. Joseph Kirby.
2054. George Tomlinson Bousfield
2083. Thomas Forsyth.
2149. William Edward Newton.
2185. William Edward Newton.
2318. Archibald Turner.
2460. William Edward Newton.
2583. Thomas Massey & Thomas Savage.
2739. Thomas Richardson and Manning Prentice.
2661. Thomas Massey & Thomas Savage.
2674. William Edward Newton.
2697. Thomas Cardwell.
2731. Abel West.
2757. William Clark.
2883. Solomon P. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

January 4th.

31. Robert Ashworth & Samuel Stott.

January 6th.

42. William Grindley Craig.
99. John Charles Pearce.
123. David Davidson.

January 7th.

66. Henry Bessemer.
67. Henry Bessemer.
72. Alexander Robertson.

January 8th.

71. John Norton.

January 9th.

63. William Thomas Henley.
88. William Barningham.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4043	Jan. 9.	Ballast or Shovel Hoe	John Gordon	3, Railway-pl., Fenchurch-st.

Journal of the Society of Arts.

FRIDAY, JANUARY 22, 1858.

PRIZE FINANCIAL ESSAY.

Essays bearing the following mottoes have been received by the Secretary:—

Métal Precieux.
Carpe diem.
X^n.
Virtus sola invicta.
E.C.S.
Counting the Cost.
Debitum Solvendum.
Labore et Fiducia.
Pecuniœ obediunt omnia.
Ubique.
Great is truth, and it prevails.
Publicus.
It is never too late to mend.
Maneant nostros ea fata Nepotes.
Finem respice.
"If thou desirest to know the value of a guinea, go and try to borrow one."
Financier.
When gold speaks, all tongues are silent.
Johannes.
Simplicity is strength.
Euston.
"Theories ruin nations; follies individuals."

EXAMINATIONS.

Drawing (Huddersfield, 1857).

The Council have awarded prizes of books to Wainman Topham, Bradford Mechanics' Institution, and Robert Wilson, Lincoln Mechanics' Institution.

NEW ZEALAND FLAX.

It will be in the recollection of Members that allusion was made in the Chairman's address* at the opening of the present Session, to the offer lately made by the New Zealand Government of prizes for encouraging the production of New Zealand Flax, of which notice had previously been published in the Society's *Journal*.† The following communications in reference to this subject have just been received from the Colonial Secretary in New Zealand:—

Colonial Secretary's Office, Auckland, Sept. 16, 1857.

Sir,—I have the honour to transmit to you the enclosed notices, as in the margin,‡ offering rewards to the amount of £4,000 by the Government of New Zealand, for the discovery of efficient means for rendering the flax and other fibrous plants of New Zealand available as articles of export.

I have also to inform you that a box, the freight of which has been paid, and the bill of lading of which is enclosed, has been forwarded to your address by the *Kenilworth*, containing the samples of flax referred to in the accompanying extracts of letters received from the gentlemen named in the margin,‖ and a further sample from Mr. Wastney,* of Nelson, with respect to which no particular observations have been furnished.

* See *Journal*, Vol. VI., p. 3.
† See *Journal*, Vol. V., p. 328.
‡ See next col.
‖ Rev. Jas. Preece, Baron de Thierry, Mr. M. Whytlaw.

The Government of New Zealand is very anxious that every publicity should be given to its desire to promote, by these rewards, or in such other way as may appear advisable, the profitable exportation of the Phormium Tenax and other fibrous plants of New Zealand, and will be happy to co-operate with the Society of Arts in any manner which the Society may suggest for the attainment of that object.

For further information on this subject I beg to refer you to H. Sewell, Esq.,† a member of the Executive Council of this Colony, now in England, whose present address is given below.

I have the honour to be, Sir,
Your very obedient servant,
E. W. STAFFORD.

The Secretary of the Society of Arts, Adelphi, London.

The following are the notices referred to in the foregoing letter:—

Colonial Secretary's Office, Auckland, December 20th, 1857.

The Government of New Zealand is prepared, subject to the undermentioned conditions, to give rewards to the amount of £4000, for the discovery of efficient means for rendering the flax, and other fibrous plants of New Zealand, available as articles of export, viz.:—

£2000

To the person who shall, by some process of his own invention, first produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, one hundred tons of merchandise.

£1000

To any person, other than the person entitled to the first reward, who shall, by some process of his own invention, next produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, one hundred tons of merchandise.

£1000

Viz.:—£200 to each of the first five persons, other than those entitled to the first and second rewards, who shall by any process, whether of his own invention or not, produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, twenty-five tons of merchandize.

The merchandize must be saleable as an article of export from the colony of New Zealand, and have been produced at a cost not exceeding 75 per cent. of its value at the port of entry from which it is exported; and the process must be fully made known with a view to the discovery being at once made available to the public.

His Excellency the Governor of New Zealand will from time to time appoint commissions, to consist of not less than three persons, to act at such places as circumstances may require, and each claim for reward will be referred to such commission as may be considered the most convenient for its proper investigation. The acts of the majority will be deemed the acts of the commission.

Each commission shall be at liberty to adopt such means as it may deem most fit for determining the value and cost of production of the merchandise, for ascertaining the process employed, and for fully investigating in all respects, and reporting upon the validity of any claim.

Every claim for reward must be preferred in writing, before the 1st January, 1859, to the principal officer of Customs at the port of entry nearest to the place where it is desired that the examination of the merchandise shall take place, who will at once proceed to ascertain whether the full quantity, in respect of which the reward is claimed, is ready for examination, and if such quantity is ready, he will give a certificate to that effect, dated on

* In error marked on the specimen as Mr. M'Glashan.
† H. Sewell, Esq., care of the Rev. Wm. Elwyn, Worsley Vicarage, Caxton, Cambridgeshire.

the day on which he shall have ascertained the fact, and such day shall be deemed to be the day on which the merchandise was produced.

Whenever any officer of Customs is required to go more than three miles from his residence, his travelling expenses must be paid beforehand by the person requiring his attendance, and he cannot be required to attend a second time if the quantity was found deficient on the first occasion.

One-half of any reward will be paid at once to any person whom a commission shall report, and the Governor shall have determined, to be entitled to the same—after which no other claim to the same reward will be entertained—and the other half upon satisfactory proof being given to the Governor of the *bonâ fide* sale of the merchandise in Europe, at an advance of not less than 20 per cent. upon the *bonâ fide* actual cost of the article landed in Europe.

By His Excellency's command,
E. W. STAFFORD.

Colonial Secretary's Office, Auckland, June 10th, 1857.

With reference to a notice dated December 20th, 1856, published in the *Government Gazette*, No. 43, of the 24th of December, 1856, offering, on certain conditions, rewards to the amount of £4,000 for the discovery of efficient means for rendering the flax, and other fibrous plants of New Zealand, available as articles of export, it is hereby notified, with respect to the first and second rewards of £2,000 and £1,000 respectively, that, although the whole quantity of 100 tons must be produced to entitle any claimant to the reward, an examination of the merchandise will take place, if desired, whenever 20 tons are ready for inspection, and will in like manner be repeated on any further separate quantities of not less than 20 tons each, until the whole amount of 100 tons is made up.

With respect to the third reward of £1,000, an examination will take place whenever five tons are ready for inspection, until the whole quantity of 25 tons is made up.
E. W. STAFFORD.

The following are the extracts referred to in the foregoing letter :—

EXTRACT FROM LETTER OF THE REV. JAMES PREECE, STAPLETON, COROMANDEL, DATED FEB. 28TH, 1857.

"I hasten, therefore, to forward to you the required specimens of prepared flax as you requested. Each number is prepared from a different variety. I have numbered them 1 to 5. The whole of the samples are very far inferior to what they would have been had they been properly cultivated; but the natives have let the plants grow wild for nearly twenty years; the plants have therefore greatly degenerated for want of culture; therefore, the colour of the flax is not so white; the fibre is also very much coarser, and not so strong as it otherwise would have been. The natives have left off the cultivation of the best flax plants for some years past (except in the interior of the Bay of Plenty, where a small quantity is still cultivated for the purpose of producing flax to make their own garments). All the flax that is sent to market is procured from the swamp variety, which is fit for making coarse canvas and rope. But all the varieties now forwarded would, if properly cultivated, be available for the purpose of manufacture, from coarse linen to fine cambric, or even some, as No. 5, to work up with silk. Nos. 4 and 5 would be very fine and white if proper attention was paid to its cultivation, as may be seen from No. 5a; that sample was from a plant that had been cultivated a little, but was not prepared with care, (it having been done by children, nearly a year ago; the bark was not properly taken off, therefore the one end is stained) yet, I thought, that it would be well to send it, because it will show the difference between the flax from cultivated plant and that of the same sort when uncultivated, although it has been both indifferently cultivated and prepared. After twenty six years' observation and attention, both to the plants and their culture, I am fully convinced that these varieties, if carefully collected and cultivated, would yield a flax far superior to that produced in any other country, and would give the most profitable export that this colony will ever produce. All the best varieties are only to be found in small quantities scattered over the country, and will, I fear, soon nearly disappear. I would, therefore, beg leave to suggest that the best and only way to secure such an invaluable article of export to this colony, would be to select a duly competent person, who is thoroughly conversant both with the plants of each variety and their mode of culture. He should be supplied with a sufficient sum of money to enable him to collect and plant a field to contain not less than ten acres; he should find the land and continue to cultivate the plants for a certain term of years, constantly giving all needful information to the public as to the best modes of culture, &c.; he should also make every exertion in his power to increase the number of plants of each variety, both from seed and roots, so that he may be able to supply the public gratis, upon producing an order from the general government.

"I am also of opinion that it would be desirable to plant an acre or two of the native cotton plant, so as to give it a trial and ascertain its real value. I am not certain about its value; the quality I believe to be good, but whether the quantity would be sufficient to remunerate both the labour of cultivation and preparation for market, I am not certain, but with respect to the flax, I am confident that the result would be quite satisfactory. No time should be lost; the field should be planted before the ensuing spring. I shall at all times be happy to supply the Government with any information on the subject, or in any other way forward their wishes on that subject."

BARON DE THIERRY'S OBSERVATIONS ACCOMPANYING SAMPLES OF FLAX.

For upwards of eighteen years I have been employed in preparing the *Phormium Tenax*, and about fifteen years ago I discovered the *Ti*, the name of which is pronounced after the Italian sound of the letter *i*.

The Phormium Tenax.

The great delicacy of the fibre of native flax (as this flax is generally called) impressed me with a belief, which many trials confirmed, that no method could be thoroughly available except such as would offer the least resistance to the fibre, and bring into use the whole length of the leaf, nor was I mistaken.

It takes about six tons of green leaf to make a ton of flax, and the waste of any available portion of the leaf must be a loss which political economists would wish to guard against, and which flax makers cannot afford.

Like other experiments I tried boiling, but it did not soften the leaf very materially; after a few boilings, an iron pot turned the flax black, and a copper or bell metal pot turned it green. The use of an alkali discoloured the flax and weakened the fibre, and the expenditure of a penny upon a pound of flax would be nearly half its market worth, and would, on a large scale, be a very serious expenditure. Flax must be made cheap or must be let alone. I tried steam, and my triumph was complete; the leaf became perfectly soft, like a well boiled asparagus. With a mill, resembling a fulling mill, I beat out the fleshy part of the leaf rapidly and efficiently, without the slightest injury to the fibre. My means were so limited that I had to study every sort of economy. For steaming chests, I substituted two tun butts; my furnace, owing to the lowness of the roof, had to be sunk underground, and would not draw except with a westerly wind; then there was no water to work the water wheel, yet, on the first day of trial, with only seven beaters, and with children who had never been in a factory before, I

made at the rate of 120 lbs. of converted flax per hour, the flax being weighed after being washed and dried. But the casks were of oak, and a stage was raised about a foot and a half in the interior with billets of firewood, to keep the leaves from touching the water distilled in the process of steaming. With sufficient steam for steaming, and with sufficient water for the water wheel, I could have made flax for sale at £15 per ton at a large profit. The colouring matter of the oak and firewood coloured the flax, as may be seen by No. 5, and yet so superficial was the colouring, that by my cleansing process, which I term the "secondary process," I have, with no other agency than water, brought the same flax to what it is in No. 3—which merchants of Auckland say is the best flax ever produced in this market. I found, too, that the deep red of the lower end of the leaves, if cut down to the bulb, yielded a colouring matter which diffused through the flax by the steam, as is shown in No. 4. To guard against these things, it is only requisite to construct the steam chambers of white wood, and to cut the leaves about a foot above the bulb; the steamed flax will be of a pale green, and after cleansing will be quite white. The efficiency of my method of applying the secondary (water) process, may be seen by No. 2. No. 1 was flax of the finest *Tihore* kind, scraped, by desire of the resident missionary at Coromandel, by natives; it smells sickly, and gradually grows darker by keeping, as the gum, which nourishes the fibre when growing, and is its bane when cut—discolours and corrodes it. No. 2 is the same flax, having undergone my cleansing or depurating process, without any other agent than water; the fibres are separating, and every day it becomes whiter and finer, because the gum is no longer there. The gummy flax is hard, and springs after being compressed, whilst the gumless flax retains the form given it without springing, and can be compressed into nearly half the bulk. All steamed flax will bear the sea without heating or becoming musty, because what portion of gum remains becomes inactive, but the gumless flax is by far the most valuable as an export, because it is ready for immediate use, and can, by heckling, be brought, without new machinery and without chemicals, to any degree of fineness.

A very erroneous impression exists about the native flax. It has been represented as stronger than European hemp, but it is not so. Whilst the strands of fibres are held together by the gum, in a yet fresh state, the strength of these strands, collected together into a rope, is amazing. By age and exposure it becomes acrid, and corrodes the fibre, and renders the rope weak and brittle, as is proved by the native baskets or kits, which are of great strength when fresh, and break to pieces when dry and old. So powerful is the effect of the gum upon the fibres, that in a few days after being cut, the leaf rolls up like a rod, and becomes brittle as straw, scarcely any trace of fibre remaining when quite dry.

To reduce the amount of labour as much as possible, rather than to seek a better method, I have dispensed with beating. I find that with rollers, of my own construction, I can turn out more flax at less cost. I have, by renewed exertions, arrived at three important results, the production of a first-rate merchandise, at the low price of £14 per ton (including purchase of leaves), rapidity of production, and freedom from gum. Flax which will not deteriorate under ordinary circumstances, which will not heat, and which requires no additional expense to be made available to the European consumer.

Without dwelling upon idle wranglings about the relative strength of European and New Zealand flax, it must be obvious that as a far greater quantity of *Phormium Tenax* could be grown in New Zealand than cotton in the United States, a most important fact presents itself,—the fact that as flax may be made gumless, and may be applied to a multitude of fresh uses, it is well calculated to develope new means of wealth to the mother country. When flax shall be cultivated, the finer sorts need cost no more in New Zealand than the coarser, and though all kinds are valuable, and though all can be made at a large profit, the largest return will be realised by the finest quality. In the event of a war with cotton-producing countries, Great Britain might be materially relieved by this hitherto costly colony. Inspection of the gumless flax will satisfy any experienced person of its adaptability to making excellent linen, and to be woven with cotton or wool into a valuable union cloth.

Although the appearance of No. 2 is so much brighter than No. 3, the close observer will find that, allowing something for the difference in the quality of the plant, the fibre of No. 3 is very little inferior to No. 2. When worked up, there will be but a trifling difference, which shows that, with similar leaves, a superior result to the native scraped will be obtained by steaming, a result the more evident, as everyone must see that No. 2 is superior to No. 1, and that I greatly improve the market and physical condition of the native scraped. The natives cannot make flax to remain unchanged or white, however much they may wash and pound it. In proof of this, I need but call attention to the finest mats they make, which are never whiter than straw-colour, and always darken with age.

The Ti.

The flax from the *Ti* is my own discovery, and I believe that competent judges in Europe will bear me out in the assertion that it is finer and stronger than the *Phormium tenax*. The sample which I send was simply beat out and washed, and the accompanying specimen of the same material, prepared *chemically* by one of our townsmen, will show how exquisitely fine the fibres will separate. I never resort to chemicals, nor do I wish to employ them, for they must always prove expensive. This flax (such as my own sample) could be sold at about £12 per ton, whilst Mr. Hornby assures me he could not make his for less than £40. The question is, of course, which would be the most remunerative? When chemicals *must* be used, I would be in favour of sending the fibre to England in its raw stage. The very plea of economy would induce me to advocate the prudence of ridding the *Phormium tenax* of its gum before shipment from this country. Water is as cheap in New Zealand as in Europe, and as water alone is needed in my cleansing (or secondary process), and as little manual labour is required, which little is fully balanced by the reduced bulk and lessened freight, I could see no reason for sending an unsound perishable material to Europe, when a sound and improving staple can be furnished at the same cost. I believe the *Ti* will be found applicable to the finest textures, from lace downwards.

The *Ti* is a tree which grows as high as 20 to 30 feet, and the flax is the product of the leaves, which are about three feet long, and from ¾ths of an inch to an inch wide. The whole tree is of a stringy nature. It is very hardy, and cuttings upwards of 6 inches in diameter will take root in moist land. It grows in swamps where nothing else will stand; it makes an impenetrable live fence; it grows either in or out of water, and prospers upon the highest hill and in the deepest gully.

I avail myself of this unexpected opportunity to express an opinion that the rule of the government, not to interfere with private enterprise, might be with great advantage departed from as relates to the *Phormium tenax* and *Ti*. Governor Fitzroy made a most praiseworthy attempt at manufacturing woollens, and it is much to be deplored that he did not persevere. A Governor clad in homespun would have been a glorious event for a young colony like this. Nothing would work out the great problem of the civilization and humanising of the native race so effectually as working upon their ruling passion, and proving to them the large profit to be derived from the manufacture, by a rapid process, of the flaxes which abound in their country. A

powerful flax mill, established by the Government, in which natives would be received and taught the easily-acquired art of flax making, would induce them to introduce that industry into their many fine flour mills, and would diffuse wealth throughout a land so depressed as this at the present time.

I say nothing of the medicinal properties of the *Phormium tenax*, as they have to be tested in a regular way. The natives make much use of it for their horses and for themselves. The gum may be the chemical agent, but of neither the gum nor the juices can I say more than that there is every reason to believe they will be found very valuable. I can save both, and it appears to me that the inquiry would be well worth the attention of Government.

The *Government Gazette* of December 24, 1856, contains an offer of £4,000 as rewards for discoveries in flax-making. I must take the liberty to observe that the Auckland Chamber of Commerce did not, in my humble opinion, give the subject the wide scope which it seemed to demand. I think more justice and more good service would have been done if a single reward of £2,000 had been offered, and that a reward had been held out to persons planting a certain quantity of flax and *Ti*. Large plantations would necessitate flax-making, and would stamp the value of the export. I think, too, that discoverers should be rewarded without reference to manufacturing, as the one should be separate from the other. I mean, of course, those persons who should discover new fibres capable of giving increased wealth to the colony. The discoverer of an available gold field would not be compelled to be a digger in order to earn his reward. I think, moreover, that instead of the minor rewards, it would have been better to promise a bounty of £5 per ton upon the 200 tons shipped under the published reservations; it would have been more likely to spur the poor man as well as the rich one to exertion.

I would wish to see the opening of a scientific Commission, under the immediate observation of the Governor, into the different modes of making flax; into the cause of the failures which have been so fatal to the best interests of the colony; into the most promising and available system of making flax, and into the advantages to be derived by each system by the home and colonial interests. Witnesses to be examined separately and upon oath. And I would gladly see the result become the basis of prospective reward, the Government, or rather the Government Commission, declaring the name of the most successful candidate, or the candidate to whose plan it might appear that most confidence might be given, but in forming a commission I would scrupulously avoid appointing any member who could be suspected of bias—none but flax-makers to be examined, in order that a practical result should be obtained.

I trust I shall be forgiven the perhaps unreasonable length of this paper—a subject of such vital importance should not be treated with levity. The worth of many millions sterling surrounds us, and as we may some day be called upon to meet extraordinary demands and expenses for which we are ill prepared, we must look upon the development of the resources of the country as a state question, sanctioning the deepest and most patient inquiry. (Signed) THIERRY.

Auckland, Feb. 17, 1857.

Extract from Letter of Mr. M. Whytlaw, dated 11th March, 1857.

"In compliance with the request which you have done me the honour to make, I have forwarded herewith three samples of our manufacture. No. 1 is the best quality we have as yet prepared, No. 2 is that of our ordinary manufacture, and No. 3 is an article which we think may suit the purposes of the paper-makers well.

"The method of preparing the native flax for the market which our firm has adopted is one which I invented several years ago; and I believe it differs from all others that have heretofore been attempted in this respect, that the fibre is separated from the leaf of the plant by a transverse action upon it, and not a longitudinal one, in imitation of the natives' method of manipulation, which so many have tried to do unsuccessfully by machinery. The whole process at our works is exceedingly simple. The flax is merely cut from the plant, passed through the machine, washed and dried. The washing is not an essential part of the process, but it serves to bring the fibre more speedily to a proper colour when exposed to the air.

"Our factory consists of a large iron building, of two floors. We have a steam engine of 15 horse-power and thirty-two machines, each of them capable, when in full operation, of producing fully 100 lbs. of prepared flax per day. Each machine requires the attendance of only one boy. Other boys are employed in cutting, washing, and bringing the flax out to dry. Hitherto we have only had a small number of the machines in use, but we are gradually extending our operations, and hope in a few months hence to produce a very satisfactory quantity per day. At present we obtain our supplies of the raw material from the natural produce of the neighbourhood, but we are preparing to cultivate the best sorts in the vicinity of our works.

"As such a business is doubtless one of Colonial importance, and promises, if entered upon energetically by capitalists, to supply what is obviously a desideratum, especially in this Northern Province, namely, a profitable export, I shall be most happy to give all the information on the subject I may be possessed of, to any parties intending to engage in it, and to show our works to any members of the Government who may honour me with a visit, or to any Commissioners who may be appointed to inquire into this important branch of our Colonial resources."

The specimens mentioned have been received, and may be inspected by members and their friends at the Society's house.

SEVENTH ORDINARY MEETING.

Wednesday, Jan. 20, 1858.

The Seventh Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 20th inst., Sir John Rennie, F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Goodchild, John James | King, T.
M'Donald, James.

The following Institutions have been taken into Union since the last announcement:—

451. Ebbw Vale Literary and Scientific Institution.
452. Neath Mechanics' Institution.

The Paper read was:—

ON THE MANUFACTURE OF PUDDLED OR WROUGHT STEEL, WITH AN ACCOUNT OF SOME OF THE USES TO WHICH IT HAS BEEN APPLIED.

By William Clay, of the Mersey Steel and Iron Works, Liverpool.

In the paper which I am now about to submit to your notice, I have endeavoured to treat of this comparatively new process, viz., the manufacture of puddled or wrought steel, with an account of some of the uses to

which it has been applied, only in a mechanical and practical point of view, and to avoid entirely any questions as to the chemical change which takes place in the conversion of the crude cast iron into steel; and I have also endeavoured to avoid instituting any comparisons between this process and any others which seek the same result, viz., the manufacture of cheap steel.

It will be well known to many interested in the manufacture of metals, and more especially to any who may have lately had occasion to visit the continent of Europe, that the manufacture of puddled steel has now been practised there for many years, and that the make is rapidly increasing, but, as yet, the uses to which this material has been put are very limited when compared with the vast advantages which would be derived from adopting so strong and durable a material, when produced at a moderate cost.

The process I am about to describe, was patented in the year 1850, by Mr. Ewald Riepe, and it may be asked how it comes to pass that so valuable a patent has been allowed to remain almost entirely unknown in this country, when it was granted so long ago as 1850. One reason is the bad state of health of the patentee, who has seldom been able to devote more than a few days, at any one time, to the subject in this country, without becoming so ill as to be incapacitated from attending to business again for a considerable time. Another reason (as I am informed) is that the patentee, about the date of the patent, came over here and entered into working arrangements with one of the most important firms in this country, viz., the Lowmoor Iron Company, who have, up to this time, made about 1,000 tons of the puddled steel, but who have not, I believe, carried the manufacture of it beyond the puddling process, but have sold the puddled bars to various Sheffield houses for them to carry into the further stages of manufacture, and more especially to Messrs. Naylor, Vickers, and Co., of that town, who have used this material very largely for the manufacture of their cast steel bells, which, I may mention by the way, are also the subject of another patent by the same inventor.

In describing the process of making the puddled steel, I cannot do better than read an extract from the specification of the patentee :—

Riepe's Patent.—"These improvements consist—Firstly, In a peculiar method of working in the puddling furnace. Secondly, In converting pig-iron, or alloys of pig-iron and wrought-iron, into steel, with the co-operation of clay in the furnace. Thirdly, In or by the cooperation of atmospheric air.

"Firstly. I employ the puddling furnace in the same way as for making wrought-iron. I introduce a charge of about 280 lbs. of pig-iron, and raise the temperature to redness. As soon as the metal begins to fuse and trickle down in a fluid state, the damper is to be partially closed in order to temper the heat. From 12 to 16 shovelfuls of iron cinder discharged from the rolls or squeezing machine are added, and the whole is to be uniformly melted down. The mass is then to be puddled with the addition of a little black oxide of manganese, common salt, and dry clay, previously ground together. After this mixture has acted for some minutes, the damper is to be fully opened, when about forty pounds of pig-iron are to be put into the furnace, near the fire bridge, upon elevated beds of cinder prepared for that purpose. When this pig-iron begins to trickle down, and the mass on the bottom of the furnace begins to boil and throw out from the surface the well-known blue jets of flame, the said pig-iron is raked into the boiling mass, and the whole is then well mixed together. The mass soon begins to swell up, and the small grains begin to form in it and break through the melted cinder on the surface. As soon as these grains appear, the damper is to be three-quarters shut, and the process closely inspected while the mass is being puddled to and fro beneath the covering layer of cinder. During the whole of this process the heat should not be raised above cherry redness, or the welding heat of shear steel. The blue jets of flame gradually disappear, while the formation of grains continues, which grains very soon begin to fuse together, so that the mass becomes waxy, and has the above mentioned cherry redness. If these precautions are not observed, the mass would pass more or less into iron, and no uniform steel product could be obtained. As soon as the mass is finished so far, the fire is stirred to keep the necessary heat for the succeeding operation—the damper is to be entirely shut, and part of the mass is collected into a ball, the remainder always being kept covered with cinder slack. This ball is brought under the hammer, and then worked into bars. The same process is continued until the whole is worked into bars. When I use pig-iron made from sparry iron ore, or mixtures of it with other pig-iron, I add only about 20 lbs. of the former pig-iron at the later period of the process, instead of about 40 lbs. When I employ Welsh or pig-iron of that description, I throw 10 lbs. of best plastic clay, in a dry granulated state, before the beginning of the process, on the bottom of the furnace. I add at the later period of the process, about 40 lbs. of pig-iron as before described, but strew over it clay in the same proportion as just mentioned.

"I do not claim the commencement of the above described process for making steel in the puddling furnace. But what I claim is the regulating the heat in the finishing process, and excluding the atmospheric air from the mass in the manner as described, and also the use or addition of iron to the mass towards the later part of the process."

The remainder of the specification it will not be necessary to allude to.

The balls, instead of being rolled into bars, may be hammered into slabs or blooms, for such uses as forgings, rails, plates, or any hammered or rolled steel which requires to be perfectly solid; but for ordinary use, puddled bars are made, at the Mersey Iron Works, from two to 14 inches wide, which are afterwards cut up and piled for various purposes.

In using the puddled bar steel, it has been found very desirable to test each bar before using it, and to closely inspect the quality, and to select such as is best adapted to the purposes required, for instance, for steel rails, or railway points, or switches, which I roll at one operation direct to the regular taper-form desired, under a patent which I have "for rolling iron or other metals of taper form." I select the most crystalline steel for the upper and under surface of the rail or switch, and for the interior that which is of a more fibrous and tougher description. Between the centre and top and bottom of the rail, I place steel of an intermediate grade, which causes the whole pile or mass to weld up easily and work solid.

It is necessary in this, as in any operation in which steel is used, to take the greatest possible care in the heating and working of the material; but from the first commencement there has been found no difficulty in heating, rolling, or forging this steel into any form or shape, as it has been made into steel plates, bars, angle steel, rivet steel, rails, railway points, and forgings of all kinds with perfect ease and with success, and ever since the manufacture was commenced at the Mersey Steel and Iron Works, this steel has been used for almost everything that was required to be of a strong and durable nature or to repair any of those breakages which are of such constant occurrence in every iron work.

It is somewhat worthy of remark that, although this process is so novel, and, apparently, of so delicate a nature, yet, with the specification as my only guide, having never before heard of or seen the operation, it succeeded perfectly in the first trial which was made, and produced so excellent a steel that, after working about 100 tons, it has hardly been surpassed. I have used pig iron of all descriptions, North Welsh, South Welsh, Staffordshire, and Scotch, with the same result, viz., the production of

an excellent steel; but I have not found, so far, anything like the great difference that I expected between hot and cold blast iron. Most excellent results have been obtained from both; this is more particularly important as it shows that the extent to which this manufacture may be carried need not be circumscribed by the very limited supply of cold-blast pig iron.

Having thus described the process of manufacture, it will be necessary to show a few of the qualities of the material produced.

The puddled-steel bar when broken shows a clear crystalline and even fracture, and has the usual sonorous musical tone when struck. The crystals appear much finer and more regular than in ordinary blister steel, in fact, to the unpractised eye, the appearance is quite like that of the best cast steel, and it has all these distinguishing features by which steel is known from iron. It hardens to any degree that may be requisite, taking all the colours which develope themselves under the different degrees of heat, and may be made into such articles as ordinary chisels direct from the puddled bar; it will take a very fine polish, and has the same amount of elasticity that steel usually possesses.

In fact, I believe it to be useful in the Arts for all purposes for which steel is required, except, perhaps, for the finer descriptions of tools and cutlery.

One extraordinary feature in regard to this wrought steel is, that it can be produced either of a harsh, hard unyielding character, or of a soft silky fibrous structure, or of any of the grades between these two points, and that a bar when quite cold may be bent up double and perfectly close (with extreme difficulty certainly on account of the great stiffness of the material) without the slightest sign of fracture, but, when forced back again, a beautiful long silky fibre is apparent; or if a piece of steel plate be partly cut through with a chisel and then broken, it appears beautifully fibrous; if made into a tool, for instance, and hardened, it at once assumes the crystalline character peculiar to steel.

In a series of experiments with regard to the improvements and deterioration which result from oft-repeated heating and laminating of bar-iron, (undertaken when writing a paper on "The Forging of Wrought Iron in Large Masses," for a work entitled "The Useful Metals and their Alloys," and detailed at page 318 of that work), I found "that taking a quantity of ordinary fibrous puddled iron, and reserving samples marked No. 1, we piled a portion five high, heated and rolled the remainder into bars marked No. 2; again reserving two samples from the centres of these bars, the remainder were piled as before, and so continued until a portion of the iron had undergone twelve workings.

"The following Table A shows the tensile strain which each number bore:—

No.		lbs.
1.	Puddled bar	43,904
2.	Re-heated	52,864
3.	,,	59,585
4.	,,	59,585
5.	,,	57,344
6.	,,	61,824
7.	,,	59,585
8.	,,	57,344
9.	,,	57,344
10.	,,	54,104
11.	,,	51,968
12.	,,	43,904

"It will thus be seen that the quality of the iron increased up to No. 6 (the slight difference of No. 5 may perhaps be attributed to the sample being slightly defective), and that from No. 6 the descent was in a similar ratio to the previous increase."

In a somewhat similar series of experiments undertaken with this steel, it appears that, after the first piling, when the bars become solid, a deterioration in respect to tensile strength takes place, which is slow and gradual, but in a regularly increasing degree, as will be found by the following Table B:—

No.				
No. 1	Puddled steel bar	bore	96,911	lbs. per sq. inch.
2	Piled	,,	121,408	,,
3	,,	,,	111,608	,,
4	,,	,,	121,408	,,
5	,,	,,	111,608	,,
6	,,	,,	111,608	,,
7	,,	,,	91,136	,,
8	,,	,,	91,136	,,
9	,,	,,	91,136	,,
10	,,	,,	91,136	,,

Mem.—The weight increased 20 cwt. at a time.

The steel used for these trials was what chanced to be at hand, and was not particularly remarkable for any extraordinary degree of strength. The appearance of the fracture of the sample bars, when broken by the hammer in the usual manner, presents to the eye a very slight difference, the colour and size of the crystals being, to all appearance, much the same in No. 2 as in No. 10; but when torn asunder by a machine for the purpose, a very marked difference is observable, the higher numbers having a very fibrous silky fracture; and yet the characteristics of steel are perfectly preserved, for No. 10 hardens, takes the usual colours, in fact, possesses all the distinguishing properties of steel.

I would wish especially to call attention to this steel as a material for large forgings and for ordnance purposes.

It is generally understood in this country that cast-steel has been, to a certain extent, a failure for such uses, and that it has been found that, unless a considerable amount of hammering or rolling be applied to the cast-steel material subsequently to the founding process, that the strength of such cast-steel material is very inferior to that where it has been consolidated by the action of the hammer or the rolls, and that it is not at all suitable where sudden strains are inevitable.

Mallet, in his valuable work on "The Construction of Artillery," argues that cast steel is not suited for ordnance on account of its deficiency in point of elasticity when compared with wrought iron or gun metal.

I imagine that this want of elasticity may be partially accounted for in this manner, viz.—Cast-steel requires a very high temperature to render it fluid for founding, which necessarily causes a considerable amount of shrinking in the casting when passing from the fluid to the solid state, and the casting is of that peculiar crystalline structure which is produced under such conditions (weakened to a great extent also by the strain caused by shrinkage), unless the steel casting is afterwards subjected to the hammering or rolling process before mentioned, by which the particles of steel are relieved from their shrinking strain, and are consolidated and allowed to assume a comparative state of repose.

In the manufacture of forgings from puddled steel, the case is very different. We possess, in the best puddled steel, as great, if not a greater amount of strength, as in cast-steel under the most favourable circumstances, and as the particles of wrought or puddled steel are never in a state of fusion from the time of their first formation in the puddling furnace, the enormous contractile strain incident upon the transition of the steel from the fluid to the solid state, is avoided in the first place, and also the grain of the puddled steel may be so placed in the forging to be made, as the strain which it will be called upon to resist may require, and the different descriptions of steel, whether crystalline or fibrous, may be arranged in the best positions as regards strength and durability. Take, for instance, a large gun forging; the interior may be made of hard crystalline steel, to resist the enormous wear and tear, and the exterior of a softer and more fibrous description, as above described, a result evidently impossible with cast steel, which must necessarily be homogeneous, and be either entirely hard or entirely soft.

It would not surprise me if, with more experience of this new manufacture, it should be found that wrought steel bears the same relative position with regard to cast steel that wrought iron does to cast iron.

There has of late been a considerable controversy respecting an alleged deterioration of wrought iron, when being made into large forgings, from a supposed crystallization of the material employed. I have always endeavoured to maintain, and in my work already referred to I have attempted to show, that where this crystallization took place it was purely the result of carelessness or incompetence.

With wrought steel, the danger from this cause is very materially lessened, indeed, rendered almost impossible, for the heat at which it welds is much less than that required to weld iron, as also if the steel be heated too much (and long before any deterioration from crystallization could set in) the forging when brought to the hammer would be so tender that it would fall in pieces, and would in that manner be wasted for the purpose required; there is, therefore, little fear that crystallization, otherwise bad workmanship, can materially injure this tell-tale production.

Steel forgings have been made, at the Mersey Steel and Iron Works into piston rods, (some with the piston forged solid, 18 inches diam., for a Nasmyth hammer), large roll screws, shear pins of all sorts, rolls for rolling iron, hammers and anvils, and for a variety of other purposes. In making these forgings no difficulty was experienced; rather more time was required on account of the necessity of heating the steel slowly, and also because the hammer did not make the same impression on it that it does upon iron.

The effect of forging upon this steel is to consolidate it, and when broken in the usual manner, the appearance of the crystals is much finer than when it is rolled, as might be expected.

Of all the various uses to which this steel may be applied, there are perhaps none so important as its application to marine and railway purposes; for the former use, the material offers directly so considerable a saving in regard to weight, with an equal amount of strength, (putting out of the question its durability and other advantages) that its universal adoption can hardly be doubted. A commencement has been made by the Board of Admiralty, who have used considerable quantities of Howell's homogeneous metal in the manufacture of marine steam boilers, as stated in the *Times* newspaper of July 6th, which says, "In consequence of the successful trials which have been made at Woolwich, of Messrs. Shortridge, Howell, and Jessop's homogeneous metal, government have given directions for the use of that metal in the construction of steam boilers, one of which is ordered to be made for the 17 gun steam-sloop *Malacca*, Captain Arthur Farquhar."

For railway purposes it is nothing new to propose steel for rails, points, and crossings, &c., as the attention of engineers has long been directed to it, both in this country and abroad, but the difficulty has hitherto been the cost of steel for such purposes. Some attempts have been made to harden the face of rails, and to steel the working parts of tyres, but, I believe, the result has not been altogether satisfactory, and the cost considerable; but with wrought-steel the tyres, points, or rails, may be made altogether of hard crystalline steel, or an outer surface of hard and an inner portion of fibrous steel, as required, and at a cost very materially less than that at which steel has hitherto been produced.

With regard to the ultimate resistance to tension of steel as compared with iron, we find by the tables recently published in the reports of experiments on the strength and other properties of metal for cannon made by officers of the United States Ordnance Department, that the strength of various descriptions of English, American, and Russian wrought-iron, tested by them, varied from 53,903 lbs. to 62,644 lbs. per square inch.

The ultimate cohesion of tilted cast steel bars, as published in Table No. 9 of Mallet's work on the construction of artillery, is stated at 142,222 as the highest, with 88,657 as the mean per square inch.

Other estimates of the ultimate cohesion of steel give,

Tempered cast steel at	150,000 lbs.
Cast steel	134,256 ,,
Shear steel	124,400 ,,
Blister steel	133,152 ,,

With wrought-steel I have also found considerable variation in regard to tensile strength, more particularly when experimenting, as it is necessary constantly to do in a new manufacture, with various descriptions of pig-iron and different charges. But when working regularly I have found no more difficulty in obtaining an uniform result than in the manufacture of iron, and with more experience we may safely expect some improvement even in this particular.

The first bar that was tested broke at 173,817 lbs. per square inch. This extraordinary endurance I have not since equalled, the nearest approach to it being 160,832 lbs. per square inch.

The average tensile strength of the steel, however, may be estimated at about 50 tons per square inch, or 112,000 lbs.

Of four samples tested at the Liverpool Corporation chain-proving machine, on the 8th January, 1858, the first bar, which was made as hard as fire and water could render it, broke at something less than 112,000 lbs., but the exact weight was not ascertained. (This trial bar was from the same steel as No. 3, which, as will be seen, bore the heaviest test in its natural state.) Test bar No. 2 broke at 112,000 lbs., or 50 tons per square inch. No. 3 broke at 125,440, or 56 tons per square inch. No. 4 broke at 98,560 lbs., or 44 tons per square inch.

Mem.—This last sample had a slight flaw, which probably caused the difference.

TABLE C.—*Tensile strength of Iron and Steel Bars per square inch.*

Descriptions of Iron and Steel.	Tensile strength.	Authority.
Russian Iron	62,644	American Board of Ordnance.
English Rolled Iron	56,532	
Lowmoor ,, ...	56,103	
American hammered......	53,913	
Krupp's Cast Steel, average of 3 samples	111,707	Minister of War, Berlin.
Cast Steel, highest	142,222	Mallet.
,, mean	88,657	Ditto.
,, ,, ...	134,256	
,, tempered......	150,000	
Shear Steel	124,400	
Blister ,, ...	133,152	
Mersey Steel and Iron Co. Puddled Steel, highest	173,817	
Ditto, another sample ...	160,832	
Average of three samples tested at the Liverpool Corporation testing machine	112,000	

This steel will also be found most useful for chains and ships' cables, and although the few samples which I have had made all broke at the weld, evidently from want of experience on the part of the smith in working this new material, yet the strains borne at the Liverpool Corporation chain testing machine, even with imperfect welds, are tolerably satisfactory, as will be seen by the following:—

	Tons.	Govt. proof strain. Tons.	Cwt.
Chain $\frac{9}{16}$ in., close link, broke at ...	12 ...	3	15
Chain $\frac{9}{16}$ in., stud link, broke at ...	13 ...	5	10

Table D.—TESTS OF STEEL, &c.

BARS 2 INCHES SQUARE, 3 FEET BETWEEN SUPPORTS, WEIGHT IN THE MIDDLE.

	HAMMERED PUDDLED STEEL BAR.				HAMMERED IRON BAR.				ROLLED PUDDLED STEEL BAR.				ROLLED IRON BAR.			
Weight on Centre.	Total Deflection.	Additional Deflection.	Permanent Total Set.	Additional Permanent Set.	Total Deflection.	Additional Deflection.	Permanent Total Set.	Additional Permanent Set.	Total Deflection.	Additional Deflection.	Permanent Total Set.	Additional Permanent Set.	Total Deflection.	Additional Deflection.	Permanent Total Set.	Additional Permanent Set.
T. C.																
3 18	·18	Nil	Nil	Nil	·28	Nil	·14	Nil	·56	Nil	·37	Nil	·84	Nil	·65	Nil
4 18	·37	·18	·14	...	1·03	·74	·79	·65	1·12	·56	·84	·46	1·21	·93	·93	·28
5 18	·75	·37	·51	·37	1·45	·42	1·21	·42	1·78	·65	1·5	·65	2·15	·37	1·87	·93
6 18	1·12	·37	·79	·28	2·03	·57	2·25	·9	2·57	·79	2·25	·75	3·56	1·4	3·28	1·4
7 18	1·68	·56	1·31	·51	3·84	1·81	3·6	1·35	3·37	·79	3·0	·75	5·06	1·5	4·68	1·4
8 18	2·15	·46	1·78	·46	4·93	1·09	4·96	1·51	...	...	...	...	6·75	1·68	6·37	1·75
9 18	2·62	·46	2·25	·46	...	...	...	...	...	...	...	...	...	...	...	...
10 18	3·46	·84	3·09	·84	...	...	...	...	...	...	...	...	...	...	...	...
11 18	4·12	·65	3·75	·65	...	...	...	...	...	...	...	...	...	...	...	...
12 18	4·68	·56	4·31	·56	...	...	...	...	...	...	...	...	...	...	...	...

	TOTAL DEFLECTION.				ADDITIONAL DEFLECTION.				PERMANENT TOTAL SET.				ADDITIONAL PERMANENT SET.			
Weight on Centre.	Hammered Steel Bar.	Hammered Iron Bar.	Rolled Steel Bar.	Rolled Iron Bar.	Hammered Steel Bar.	Hammered Iron Bar.	Rolled Steel Bar.	Rolled Iron Bar.	Hammered Steel Bar.	Hammered Iron Bar.	Rolled Steel Bar.	Rolled Iron Bar.	Hammered Steel Bar.	Hammered Iron Bar.	Rolled Steel Bar.	Rolled Iron Bar.
T. C.																
3 18	·18	·28	·56	·84	Nil.	Nil.	Nil.	Nil.	Nil.	·14	·37	·65	Nil.	Nil.	Nil.	Nil.
4 18	·37	1·03	1·12	1·21	·18	·74	·56	·93	·14	·79	·84	·93	...	·65	·46	·28
5 18	·75	1·45	1·78	2·15	·37	·42	·65	·37	·51	1·21	1·5	1·87	.37	·42	·65	·93
6 18	1·12	2·03	2·57	3·56	·37	·57	·79	1·4	·79	2·25	2·25	3·28	·28	·9	·75	1·4
7 18	1·68	3·84	3·37	5·06	·56	1·81	·79	1·5	1·31	3·6	3·0	4·68	.51	1·35	·75	1·4
8 18	2·15	4·93	...	6·75	·46	1·09	...	1·68	1·78	4·96	...	6 37	·46	1·51	...	1·75
9 18	2·62	...	...	...	·46	...	...	...	2·25	...	...	...	·46	...	...	...
10 18	3·46	...	...	...	·84	...	...	...	3·09	...	...	...	·84	...	...	...
11 18	4·12	...	...	...	·65	...	...	...	3·75	...	...	...	·65	...	...	...
12 18	4·68	...	...	...	·56	...	...	...	4·31	...	...	...	·56	...	...	...

Table D gives the deflection of hammered and rolled bars of steel and iron with increasing weights.

The samples, as I have since discovered, were of too soft a description, and better results would have been obtained with harder steel, or perhaps the best results might be obtained by a mixture of hard and soft steel, the hard being placed above the neutral axis, the part which is deflected by compression, and the soft, which is deflected by extension, below.

In experimenting upon the strength of this steel, I found the weight requisite to punch steel and iron plates was relatively as follows. The plates were all ¼-inch thick, and the size of the punch ½-inch (circular).

	Tons.	cwt.
Ordinary boiler plates, punched with a pressure of	8	18
Charcoal ,, ,,	8	3
Steel ,, ,,	15	10

In several trials of the tensile strength of steel plates, it was found that the strain required to break a square inch of this steel varied from 44 to 55 tons.

It may perhaps be well to mention also, that there is no difficulty in working this steel, either hot or cold, in any manner in which the best descriptions of iron are worked, and that no particular knowledge or skill is required on the part of the workmen who use it.

These results show the importance of steel as a material for boilers and shipbuilding purposes, as also for girders and bridges, as the economy in the weight of material required is of the greatest importance for these and for many other similar purposes.

In conclusion, I beg to apologise for the very imperfect paper that I have had the honour of laying before you, but I would plead in excuse the very limited time that has elapsed since I first commenced the manufacture of this material, and also that, from the extraordinary and novel nature of this steel, I have been often much perplexed and puzzled, and have had to renew experiments again and again before I could fully comprehend the sometimes apparently contradictory facts which presented themselves, and added to this that it was in the first place necessary to unlearn a good deal of what I had always been accustomed to look up to as the foundation of all knowledge of the iron and steel manufacture, a task much more difficult than the acquisition of any new idea, when the mind is not occupied with preconceived notions and old established prejudices.

In the experiments which I have tried, I have taken every care to be as accurate as possible, and as the trials have gone on, I have had more and more cause to feel confidence in the result obtained, and, had time permitted, I should have been glad to have extended the trials, as the more I investigated the nature of this material the more satisfactory I found it.

I do not for a moment anticipate that steel manufactured by this patent process will supplant the best description of steel, but I feel confident that it must come largely into use for most ordinary purposes, where cast-steel, from its great cost, cannot be used.

Indeed, if I might indulge somewhat in prophecy, I would express my belief that, in a few years, the manufacture of this wrought steel will have become as important a branch of our national industry as that of iron now is.

If the few facts which I have, however imperfectly, placed before this Society, lead to further inquiry by others more competent, and having more leisure to conduct them to a successful issue, I shall be amply repaid for the time and pains that I have bestowed upon the subject.

The following letter has been received by the Secretary:—

Sheffield, Jan. 19th, 1858.

SIR,—I have read Mr. Clay's paper, a proof copy of which you forwarded to me. It is not only of great interest, but highly instructive to all in the present state of the manufacture of steel. When the production of a steel by puddling becomes more developed and improved, it will be applied to many useful manufacturing purposes, as well as to civil engineering.

Mr. Clay describes Mr. Riepe's process, which originated in Westphalia. The idea of manufacturing steel in a puddling furnace emanated from a process long practised in Germany for making natural steel, called "German steel;" and on a close examination, the effect produced upon the pig-iron used will be found to arise from similar causes. In the manufacture of steel by the puddling process, the object is to decarbonise the crude iron acted upon, and this is attained by allowing it to remain for some time in a fluid state, acted upon by the air which passes through the furnace, and assisted by the addition of a silicated oxide of iron, which is largely added to the metal when in fusion. The mass then becomes to some extent decarbonised, but the iron cinder which has been added has induced the production of a silicate of iron, which, however, is decomposed by the addition of a flux, similar to that used by Dr. Schafheutel in his patent process for producing steel-iron; the oxide of manganese which is used then forms a silicate of that metal, whilst the alkaline property of the other ingredients assist in liberating the iron, which has now nearly arrived at a malleable state. The remainder of the process is a carbonising one, and requires much care and experience from the workman. The raw steel so obtained is subject to many imperfections, from the nature of the means taken to produce it, and as such, whilst it is very useful for many purposes where strength is required combined with lightness, yet it has been found unfit for any hardware purposes, excepting the commonest articles. In Germany, the raw steel is doubled and welded many times before it is used for manufacturing purposes, and even then its molecular construction renders it unfit for making a file or cutting tool, whilst, on the other hand, it is well suited for railway tyres, switches, &c.

Metallurgical processes are progressive. Mr. Clay has detailed to us the mode of producing the material, and he has, with his practical ability, carefully examined the changes which the iron undergoes in the furnace. He is aware of the nicety of the operation, and, consequently, the necessity of careful as well as skilled labour to produce a uniform quality. Doubtless he has noticed many imperfections in the process, and a close examination of the steel so produced has shown him that the atomic construction of the metal is far from perfect. I would, therefore, earnestly draw his practical attention to the fact, that the means adopted for carrying out the theory upon which the process is based, may be rendered more perfect. I would ask, is it necessary to add so large a mass of deleterious matter to the fluid metal to obtain a simple decarbonisation? Mr. Blackwell, in his paper on iron, read before the Society in May, 1855, states, "that it appeared desirable to introduce between the blast furnace and the puddling furnace some intermediate process, which, like that of the *mazéage* of France and the continent generally, should sufficiently decarbonise the grey pig iron at small cost in labour and fuel." This desirable object I have attained by subjecting crude iron, from the blast furnace or a cupola, to the action of any chemical re-agent capable of disengaging oxygen during its decomposition,—thus carbonic acid, or carbonic oxide gases, will be produced by the decomposition of the substance, and by the union of the oxygen contained therein with the carbon contained in the fluid iron from which it is eliminated; the gases so produced, being unable to re-enter the metal, either pass off in vapour, or act upon the silicates or other earthy compounds which the crude iron may contain, precipitating the metallic part, and allowing the earthy matter to flow away as slag, containing compara-

tively but a very small per centage of iron. Thus, by adding a chemical re-agent, which by its decomposition will evolve elements capable of combining with the carbon contained in the iron, and of producing carbonic oxide gas, which, acting upon the earthy compounds, and other deleterious matter contained in the iron, causes such deleterious substances to separate from the iron, I obtain very clean, pure, crystalline metal, capable of being manufactured into superior malleable iron.

I would suggest to Mr. Clay whether such a plan of decarbonising the crude iron be not preferable to the one now adopted, and whether such a modification of the manufacture of puddled steel would not prove to be one step towards perfecting the production of so desirable a metal. I produce a few pieces of my refined and purified metal, which is patented, and since the production of such a description of steel will daily become more and more useful for general engineering purposes, I shall, with pleasure, answer any inquiry upon the peculiar process for producing this refined metal.

We are greatly indebted to Mr. Clay for his varied and careful experiments upon the comparative tensile strength of this metal with iron. The extraordinary degree of strength obtained seems a guarantee for its usefulness for railways, steam navigation, and other purposes.

Mr. Clay has confined his paper to the consideration of puddled steel, and as he wishes to avoid all comparison, I will not enter upon any discussion as regards the usefulness of this steel compared with others now produced, yet I cannot agree with the assertion that cast-steel is unfit for ordnance. The observations as regards shrinkage are, generally speaking, correct, but I wish to remark that the crystalline structure of cast-steel becomes very much varied by the different degrees of heat at which it is poured into the mould. A large quantity of cast-steel is made in Sheffield, for the manufacture of rifles in America, and also on the continent. All steel for such purposes must, of course, be hammered, but cast-steel does not require it so much in making ordnance as malleable iron or puddled steel. However carefully iron ordnance may be manufactured, I much fear they will not be found permanently useful or serviceable, because no weld can be made absolutely perfect when two coats of oxide intervene between the solid metal, as in the case of piling the iron or steel used. I think practice would prove that the mass must become gradually weaker with the continued concussion.

As regards the cost of steel, it may, perhaps, not be known to Mr. Clay, that in Sheffield a steel can be manufactured similar to the puddled steel at less cost, and fully equal in quality, if not, in some instances, superior; it is obtained by puddling the refined metal before alluded to, and then converting it, at a cost of 18s. per ton, which being added to the cost of good sound and properly puddled bar, gives the cost of a similar material to the puddled steel which is sold in Sheffield. The difference which exists between these two kinds of rough steel is, that whilst the converted has only absorbed a certain portion of carbon, in the puddled one it is chemically combined; it is this latter quality which renders the German natural steel more useful than the English steel for miners, since it retains its carbon to the last.

As regards cheap steel, the controversy which so lately appeared in our scientific journals, shows that a practical knowledge of the manufacture of steel, and particularly of cast-steel, is extremely limited, and, at the same time, very imperfect. The intelligent steel-maker in Sheffield has long known the use of common materials, and can extract the maximum amount of usefulness from them—he knows that such steel is only fit for certain inferior purposes. If a steel be wanted for a tap, a die, or for a tool to turn a case-hardened roll, his knowledge leads him to select raw materials freed as much as possible from deleterious matter, and he will so manufacture them that the product shall be fitted for its destined object.

I fully concur in Mr. Clay's remark, that puddled steel, if properly and carefully manufactured, will come gradually into use, and prove highly beneficial both to the practical and civil engineer.—I am, &c.,

CHARLES SANDERSON.

DISCUSSION.

Mr. Newton would ask one or two questions of Mr. Clay, first, with reference to the price at which he could produce the puddled steel of the quality similar to the samples on the table. He thought the cost of the steel, as it came from the puddling furnace, of great importance in considering the commercial value of this process. Mr. Clay had briefly alluded in his paper to the manufacture of ordnance from steel and wrought iron; a little more information on that subject would be interesting. He gathered from the paper that the interior of the cannon was to be of hard steel, whilst the exterior was of a softer and more elastic material. He would be glad to hear some further explanation of this. He also wished to hear some explanation with regard to the difference mentioned between the results of Mr. Clay's experiments and those of the Liverpool Corporation, in proving the strength of this material and the strain it would bear in the form of chains and bars, the difference being so great as to call for remarks. He should further like to be informed whether the experiments quoted were made with square bars or round bars with an area equal to the square inch. Mr. Clay had referred—he thought too briefly—to the manufacture of plates from this patent puddled steel. He thought further information on that point desirable. With regard to the views expressed by Mr. Sanderson, in the communication just read, he (Mr. Newton) thought that gentleman must be under some mistake in stating that the cost of the conversion of iron into steel was only 18s. per ton. He was afraid Mr. Sanderson had deceived himself upon that point, but perhaps practical gentlemen he saw present could enlighten them on that matter.

Mr. Vickers (of the firm of Naylor, Vickers and Co.,) stated that he had tried numerous experiments with the puddled steel, and referred to various specimens on the table as examples of the excellence of the material. With regard to the question of cost, he thought Mr. Sanderson had placed it too low. He believed it would be found that the cost of converting iron into steel would range between 22s. and 25s. per ton with all descriptions of iron—English and Swedish. He had not tried Sanderson's refined steel. The puddled steel manufactured by the Lowmoor Company had not come much into use, owing to the high price they had put upon it. Cast-steel made from puddled steel was more malleable than the generality of English iron converted into steel, and was well adapted for shafts, spindles, and other portions of machinery. He had also used it extensively for cast-steel bells.

Mr. Hobbs was desirous of having some information with regard to cost, particularly with reference to the combination of hard and soft metals in ordnance, as described in the paper.

Mr. Bevan regarded cost as an important element in the consideration of this subject. It was desirable that they should know whether this steel could be produced of a tolerably uniform quality, and at a lower price than the ordinary descriptions of steel now in use. As far as he could judge at present, one of the merits of this invention was the cheapness at which the steel could be produced. Mr. Clay had alluded to variations in quality in the same mass, particularly with reference to rails. In rails especially, what they required was a hard steely surface, with a heavy, tough base. He should like to hear whether Mr. Clay, by this invention, could attain that desirable object at something like a moderate cost, as compared with the old system. If that could be

effected, it would lead to the consumption of a vast quantity of this new kind of steel.

Mr. CHARLES MAY regarded this invention as the commencement in this country of the most important movement in the metallurgy of iron that had taken place for many years past. He had had his eyes upon the various improvements introduced into the manufacture of iron, particularly the method introduced by Uchatius. In most of these there seemed to him to be many important practical objections. As to granulating pig iron and melting it in crucibles, it was a "peddling" process, producing a commodity by pounds which was required by tons. One of the most important services that could be rendered to society would be the production of a steel suitable, not so much for the finer description of tools, as for rails and similar purposes, at a cost not much higher than that of the material now employed. If that were done, they might have a really permanent way upon railways, which, at present, did not exist. This process, if brought into general use, would be improved upon as the manufacture proceeded. They must not be discouraged because it was not yet perfect. The great thing was to encourage manufacturers to carry it on. They were aware of the great difficulty of introducing improvements of any kind in iron works. The ironmasters were, for the most part, men of great wealth, and did not care about improvements. If by this process they could get steel rails at 50 per cent. above the cost of the ordinary iron rails, it would be a very great boon. This material might enter into every part of the structure, not only of the permanent way of railways, but also of the entire rolling stock. It would enable them to lighten the rolling stock; and whilst in one direction they increased the resisting power of the permanent way, on the other hand they decreased the force of the destructive effects upon it; he therefore looked hopefully upon this process. It however struck him as an extraordinary thing that fifteen or sixteen shovelfuls of cinder slag should be used to 300lbs. of iron. He had no doubt that experience would lead to a considerable reduction in that quantity. He understood that, in this process, decarbonizing was the principal thing, although the theory had been set up that carbon was not the only important element in the conversion of iron into steel. Mr. May then entered into a brief description of Siemen's furnace for the admission of heated air, the result of the use of which was, as he had been informed, that in a steel furnace upon that principle a ton of metal was melted with a consumption of only 10 cwt. of coke, as against 90 cwt. with the ordinary furnaces, and Mr. Siemens was at present engaged in applying the same principle to puddling furnaces.

Mr. NEWTON believed at present very little had been done with reference to the manufacture of steel rails, to which Mr. May very justly attributed so much importance, but steel points had been somewhat extensively introduced. Hitherto some difficulties had been experienced with regard to steel rails, inasmuch as although the hardened surface was better calculated to resist wear and tear than the ordinary iron rails, yet the brittle character of the steel was found to be an objection. Mr. Sanderson had lately taken out a patent for hardening and tempering rails, whereby the strength was much increased, and he thought this process would tend to effect that which Mr. May considered so desirable, namely, the providing a really permanent way. He, however, was not able to state what would be the advance of price of Sanderson's process of hardening over that of the ordinary rails.

Mr. WILLIAM HAWES would say a word in defence of a very large body of, he believed, intelligent and able men engaged in one of the most important manufactures of this country. Mr. May had told them that the ironmasters were slow to adopt improvements, and for that reason he was afraid to entrust any new process of manufacture to them; at the same time Mr. May looked hopefully to patents taken out by persons not belonging to that class. It was dangerous in a Society of this kind to indulge in wholesale condemnation of any class of manufacturers. He believed the iron-masters of this country would be found always ready to adopt any new plan of real practical utility, for their own benefit in the first instance, and afterwards for the benefit of the community.

Mr. KITTOE said, although not practically acquainted with the manufacture of iron, yet he had tried steel of a similar character to this in the construction of the larger description of taps, and he had found that, in many cases, the metal would not harden without splitting. At the same time, he had made tools for turning purposes from this kind of steel with satisfactory results.

Mr. WM. SMITH remarked that, in the tables A and B, he saw nothing to indicate whether the strains applied were per square inch of metal. He should be glad to be informed as to the description of testing machine employed in these experiments. Another material question was, how this metal behaved under the test?

Mr. CLAY said, before replying to the questions that had been asked, he begged to say that he was only interested in this process as any other iron manufacturer might be. The firm with which he was connected merely worked the patent under a license, but, considering it a subject of vast importance to the engineering interests of the country, he had felt it his duty to bring the subject before the public at the earliest possible date, although, perhaps, a little more time would have enabled him to have put the matter forward in a more complete form. In reply to Mr. Sanderson, the manganese, although mentioned in Mr. Riepe's patent, was not an essential element in the manufacture of the steel, nor was the use of it claimed by him. With respect to the large quantity of cinder slag used, it appeared to be absolutely essential to the success of the process, being used to protect the molten crude iron from the action of the atmosphere. The difficulty in welding, that had also been noticed, was not experienced in working this material. He (Mr. Clay) could confirm what had been said as to the suitability of this steel for miners' tools, it having been used in some of the mines of North Wales with great success. With reference to the cost of manufacture, he felt no doubt that this would be materially reduced as experience was gained, but even at the present early stage, he thought that Mr. May's desire to have steel rails costing only 50 per cent. more than iron ones might not be far from being realized, and that ultimately the cost would probably not exceed that of iron by more than 10 or 20 per cent. With regard to ordnance, on which some further information was desired, he wished it to be clearly understood that he anticipated no difficulty in the manufacture of guns, as described in the paper. The facility in welding this material gave the manufacturer the opportunity of placing the different descriptions of steel, whether hard or soft, in the particular positions required. A hard crystalline steel might be used as the first layer, from which the bore would be taken out. The exterior would be of a softer metal, more elastic than the interior portion, and better able to withstand the immense concussion of the discharge. With reference to the difference alluded to in the results shown by the experiments made at the Corporation testing machine, and those in his (Mr. Clay's) own works, this was caused by the difference between the samples of steel employed. It would be observed that the variations were not nearly so great as in the experiments detailed in Mr. Mallet's work. The bars tested were half-inch square, and the results were, of course, calculated from them. The testing machine was a powerful steel yard, which was attached to one end of the bar, the other end being firmly fixed to a strong bed-plate, and the weight gradually increased until fracture ensued. With regard to the rolling of steel plates, many tons had been successfully produced and tested, the average tensile strength being about the same as that of the bars.

They were also remarkable for being very easily worked either hot or cold, and were particularly easily caulked; they were also less liable to corrosion than iron. As to the practicability of making rails with a hard surface and a soft base or centre, it was shown in the paper that this was one of the special advantages of the process. In reply to Mr. Kittoe, it had never been proposed to use this material for such fine purposes as taps and dies, but after having been melted in the usual manner it might be so employed.

Mr. Charles May remarked with reference to the power required for punching holes in iron plates, that it was laid down by Colthurst, that to punch an inch hole in an inch plate required a pressure of 150,000 lbs. which came so near to the results mentioned by Mr. Clay that he was inclined to place great faith in the other experiments detailed in the paper.

The Chairman proposed a vote of thanks to Mr. Clay for his valuable paper, and also for the candid and straightforward manner in which he had replied to the numerous questions that had been put to him.

A vote of thanks was passed to Mr. Clay.

The Secretary announced that on Wednesday evening next, the 27th inst., a paper by Mr. J. G. Crace "On the Use of the Soulages Collection of Italian Art in Modern Art Manufacture," would be read. The Manchester Art Treasures Committee have kindly permitted a few specimens of the collection to be exhibited for the purpose of illustrating Mr. Crace's Paper.

The Secretary has received the following letter since the meeting:—

Dear Sir, — Having duly received your obliging intimation of the subject to be brought before the Society of Arts this evening by Mr. William Clay, I regret that I am not able to attend personally—not that it would be in my power to give any useful information on the practical manufacture of steel, but because I should have much pleasure in confirming the remark made in the paper, to the effect that the experiments made at this factory with what is called "homogeneous metal," have been so satisfactory as to have led to the order for three sets of boilers being made at this factory for vessels in H. M. service. Not only is this metal much stronger than the best iron, but there is reason to expect that it possesses the property of being less corrodible, which is a very important consideration in the matter of marine boilers, and I need scarcely observe that the relation of strength to weight, which this metal possesses in a superior degree, is of great importance in the construction of quick-action machinery, such as is now being introduced in marine engineering. I also beg to add that we have found the working properties of this material to be satisfactory, and readily acquired by workmen conversant with the working of steel.—I am, &c.,

CHAS. ATHERTON.

Woolwich Dockyard, Jan. 20, 1858.

LITERARY AND MECHANICS' INSTITUTIONS OF LANCASHIRE AND CHESHIRE.

The following appears in the last number of the *Institutional Gazette*:—

In issuing the programme of the Public Examination of the Institutional Association for the present year, we would express a hope that it will be found to meet the wishes and answer to the experience of the managers of our Institutes. Our solicitude has been directed to circumscribe in our examinations the largest number, who may be encouraged to venture into the arena.

Every one may not be a Paladin, but no one, however timid, need fear his equals. If a candidate's acquirements may be only just above zero,—or if he be unsuccessful after a trial of his strength, he will at least be better armed for a future tilt. He will be better trained; he will see where he is weak; he will be encouraged; and at a future day, industry and perseverance will make him successful.

Our last public examination was a great triumph,—the number of candidates was quite unhoped for,—and the responses to the Examination Papers reflected the highest credit, not only upon the candidates themselves, but upon those gentlemen who stand at the head of the various Institutions in the Union. If anything could add to the satisfaction of the Central Committee, it is the fact that candidates who won prizes and certificates at our public Examination in Manchester for mathematics, were also victorious at a subsequent public Examination held at Burnley; and had the great honour of receiving from the Lord Bishop of Manchester their rewards for excellence and merit.

This conjunction of success has encouraged the Central Committee to persevere in the continuance of their Examinations; it has confirmed us in our opinion of the excellence and judgment of our staff of Examiners, and has solidified the confidence of the public in the practical value of the labours of all engaged in promoting the efficiency of the Institutions in our Union.

The Central Committee relied upon the good services of the local managers of our Institutions, spread over these two counties; without vigour and interest on their part, little success could be hoped for. The confidence reposed in them by the Central Committee was not misplaced. The Secretaries of Institutions laboured diligently, and their efforts were rewarded, as they deserved to be, by the honourable position attained for the Institutions, by the success of their candidates.

We congratulate the association upon the fact, that we are now *de bon accord* with the Society of Arts; that any diversity of aim or interest should have arisen was, to us, a matter of regret. While we are desirous of welcoming all coadjutors in promoting the interests and elevating the character of Mechanics' and Literary Institutions, we could not permit ourselves to be ignored; nor could we permit, on the other hand, a meretricious fame to divert us from the object we have constantly at heart. There has been no real antagonism between the influential members of the Society of Arts and the Central Committee of the Institutional Association. Our wishes with regard to Institutions have been the same. But it could not be expected that this confederacy of Institutions would yield their local influence, or that the Central Committee should sanction a *coup d'état* which we could see would only tend to enfeebling our efforts, and might ultimately terminate in destroying our Union.

We felt the great responsibility of our position, and we were determined not to sacrifice the interests committed to our sacred keeping.

The Society of Arts, under more able and more friendly influence, invites us to assist in a common work. We gladly do so—we are allies—and the influence of this loyal alliance will be felt throughout our Union. The Central Committee believe that they possess the confidence of the Society of Arts; and this belief is shown by the fact, that the papers for the forthcoming public Examination will be based upon the programme issued by the Society of Arts. This cordiality of spirit, and unity of purpose, will conserve also the interests of candidates intending to present themselves for examination. It will enable our examiners to place before candidates the examination papers issued by the Society of Arts and those issued by the Association at the same instant; upon the same subjects; to be submitted to or supervised by the same Examiners.

The Central Committee feel great pleasure in thus acknowledging the courtesy shown by the Society of Arts, persuaded that no *jalousie du métier* need intervene to prevent common action for a public good. There is no forfeit and no sacrifice.

RESIN OIL FOR BURNING IN LAMPS.

In the manufactories now established for preparing resin oil in various countries, many trials have already been made for preparing it in a state fit for burning in lamps, it being thought that if the resinous parts which prevent its burning in ordinary lamps could be removed, and these lamps could be constructed so as to allow the resin oil to be burnt in them, they would furnish in this way a light of great intensity at a very small expense.

It is stated that the proprietors of a manufactory of resin oil, near Wiesbaden, have at last succeeded, after continued trials, in purifying it, and in constructing ordinary lamps with a never-failing reservoir for the oil. The Argand burner, with a double draft of air, by merely a small alteration, has been rendered available, producing a beautiful white light, which, with a diameter of 1·2 centimetres, is equal to the light of four stearine candles, at $\frac{1}{20}$th of the expense. The light is said to be so intensely bright that it is even painful to the eye.

A resin oil lamp, giving the light of four stearine candles, consumes in one hour $\frac{3}{8}$ths of an ounce of oil; one pound of this costing about 4d., so that the consumption in one hour is about one-tenth of a penny.

A further advantage of the above-mentioned lamp is stated to be its extreme simplicity in construction.

SOUTH KENSINGTON MUSEUM.

During the week ending 16th January, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,289; on Monday, and Tuesday, (free evenings), 3,139. On the three students' days (admission to the public 6d.), 771. One students' evening, Wednesday, 483. Total, 7,682.

Home Correspondence.

ON LOWERING VESSELS, &c., DOWN INCLINES.

SIR,—The following plan, which I propose for enabling ships, &c., to be moved down low inclines, or raised up steep ones, has been specially adapted to the case of the *Leviathan*, but the object has been kept in view of affording hints which may be useful on future occasions, as there appears to be a disposition to adhere to the original plan, as regards the *Leviathan*, and increase the force until it is sufficient to propel the vessel down the ways with a sliding action, notwithstanding the expense and delay which the enormous friction of the method necessitates.

The plan I propose consists in partly substituting a rolling motion for a sliding action, by introducing a large number of cannon balls beneath the cradles, and it would be applied to the *Leviathan* as follows:—

Between every second or third rail of the present ways there would be laid a trough-shaped rail, passing from the upper side of the cradle under the ship to the bottom of the "ways;" the width of the trough would be little more than the size of the shot, which, in the present instance, would be small, say six pounders, and the depth about half the diameter. Plates would be placed above these for the upper side of the balls to roll over, which would extend the width of the cradles. These plates would be 12 inches wide, with a flange along each side of about 1 inch deep, and the inner face would be slightly concave from the sides to the centre, in order to allow for the lower troughs not being accurately parallel with each other all along the ways, and yet give the cradles a tendency to keep the upper plates in the centre of the lower troughs. This would provide for five or six times the error which need exist in the troughs, as they would be laid as nearly parallel with each other as practicable, and it would also allow for the tendency which one end of the vessel has to precede the other, even though it should do so to the extent of 18 feet, as there would still be plenty of room between the balls and the side flanges.

The lower troughs being laid on the cross beams which support the present rails, the upper plates would be introduced above them, leaving a space of about a quarter of an inch between their upper surfaces and the lower surfaces of the present iron cross bars. A ball would then be introduced into the trough, and retained in its place, immediately under the outside cross bar, by a rod passed up the trough from the lower side of the cradle, until a steel wedge had been inserted between the cross bar and the plate, and driven in a little. The next ball would then be passed up the trough and retained under the second cross bar in the same manner, and so on until a ball had been placed under each, when the wedges would all be driven tight.

The balls in the next line of trough would not be placed under the cross bars, but half-way between them; those in the next trough would be placed like the first, and so on alternately throughout the series, in order that when the vessel was in motion, one set of balls should be under the firmest part of the structure, whilst the other set were passing over the less supported part of the troughs, which would then be subjected to deflection.

After all the balls had been introduced, which would amount to 4,500 if placed between every second line of the present rails, the wedges would be driven home until a sufficient portion of the weight was removed from the rubbing surfaces on the rails to the rolling surfaces on the balls, to enable a comparatively small force to drag the vessel down the ways; and in order to ascertain by actual trial when this was accomplished, and the forces properly balanced, the strain would be kept on the vessel whilst the wedges were driven home, and the driving continued until the force applied was sufficient to cause it to move, and then the vessel would be immediately stopped again by clamped blocks, placed 2 or 3 inches below the front of the cradles, which would extend across all the rails, to prevent the possibility of the vessel moving farther than it was intended to do. The men would stand upon the cradles to drive the wedges, so as to be out of danger when the vessel moved over the allotted distance of 2 or 3 inches, after which "jack shores" would be placed against each end of the vessel, to afford security whilst the clamp blocks were removed from the rails, as the shores could be removed without any men being in the course of the vessel when the time had arrived for starting it.

As a matter of precaution, the upper plates would be bolted to the cradles, although they would have little tendency to move by the balls rolling under them, whilst their upper surfaces were restrained by contact with others which must rub and not roll.

In order to keep up the supply of balls, and bring them into action as others rolled out, a self-acting arrangement would be placed on the lower side of the cradles, at the commencement of each upper plate, which would place a ball in the trough, and give it a blow at the same time sufficient to cause it to hold in the entrance, and then the upper plate being a little tapered towards the end, it would cause the ball to be brought under the full pressure as the incline rolled over it. The arrangement would be made to supply the balls at any intervals that might be desired, and communications would be carried up to the deck by which the intervals might be altered, and the resistance of the vessel regulated to some extent whilst it was in motion.

If additional power over the motion were thought worth the expense, the arrangement might include bars for locking any number of the balls in the troughs, and converting the rolling to a sliding action.

At present, a notion seems to prevail that a sliding action is safer for lowering vessels than a rolling motion,

but upon what grounds it is not easy to imagine. It seems to me the safest motion must be that in which all the forces remain as constant and little subject to change as possible, and that this is most easily attained with a rolling motion, because the friction forms so small an item that its irregularity does not prevent the result being calculated and provided for with tolerable certainty, whereas, with a sliding action, the friction forms so large an item, which is subject to change by a difference of smoothness in the surfaces and in the quantity of lubricating matter between them, that it may suddenly require a much larger force to overcome it at one instant than at another, and give rise to starts and stoppages similar to those which have been exhibited in the motion of the *Leviathan*.

All that can therefore be converted from a sliding action to a rolling motion is so much taken from an uncertain method, and added to the side on which the focus can be accurately calculated and balanced.

Another notion seems to prevail that there is less friction between wood sliding on wood than with iron over iron; but some experiments which I have made leave little doubt about there being more friction with wood than with iron under a pressure of 280lbs. to the square inch, which is the pressure of the *Leviathan* on its rubbing surfaces, and that the fact of vessels being launched from low inclines on wooden ways must therefore be attributed to something else. In these launches the surfaces are very extensive, and coated with a thick layer of lubricating matter, so that the vessel is really afloat before it reaches the water, not on a thin fluid it is true, but on a fluid which is sufficiently thick to resist being quickly pressed out from between the surfaces, so as to allow them to come into actual contact, and before this occurs the stern has been lifted up by the water, and the vessel acquired sufficient momentum to enable it to clear the ways. In these launches care is taken to arrange the surfaces, so that the lubricating matter cannot easily escape from between them, but in the *Leviathan* the surfaces have been arranged so that the upper ones act as scrapers to the lower ones, and clear away the lubricating matter as effectually as though they were special contrivances for the purpose.

I am, &c.,
E. T. LOSEBY.

Proceedings of Institutions.

Birmingham.—On Monday, January 11th, the annual meeting of the subscribers to the Birmingham and Midland Institute met in the Lecture Theatre, Paradise-street. Mr. Arthur Ryland (in the absence of Lord Hatherton, the president) occupied the chair; and there were also present Alderman Manton, Councillors Heaton and Smith, Messrs. Abel Peyton, W. Matthews, junr., Brooke Smith, Blakemore, John Jaffray, H. Wiggin, G. Jabet, F. Osler, Saunders, T. Martineau, R. Wright, S. Barker, G. J. Johnson, R. Peyton, jun., Horton, W. Shakspear, J. S. Dawes, T. W. Williams, Albitès, W. M. Williams, T. P. Salt, Gold, W. R. Lloyd, P. Hollins, T. Kenrick, Hopkins, J. S. Wright, the Rev. C. Clarke, and others. The Chairman, after reading a letter from the President, explaining the cause of his unavoidable absence, said he must congratulate them on meeting in that theatre, built from the designs of Mr. Barry, and from the experience of every lecturer who had been heard in it, fully answering the expectations of the most sanguine amongst them. The working part of the Institution was in an excellent and flourishing condition. It had taken a most proud position—a position which he never expected to see it take—in so short a time. Looking back it seemed but a very limited period since it was projected. When they spoke of raising £10,000 for building, they were greeted with an incredulous smile; when they talked of uniting all classes in an Institute, they got the same smile once more. Yet they had done both these things, and had done them well. Still much remained to be done, and he was confident that what was still to be done would be done with success, because he knew the men who had brought the Institute to what it was, would work it out to a satisfactory conclusion.—Mr. Mathews, the honorary secretary, then read the report. It congratulated the members upon the increasing efficiency of the general and industrial departments, upon the completion of the new lecture theatre, and upon the rapid progress of the remainder of the first portion of the new building. Since the last annual report, 146 new members had joined the Institute, making the total 484. The lectures for the past year were then alluded to, and those for the current year were indicated. The Patent Specification library appeared to have been of considerable utility, 240 persons having consulted it during the past year. The council also acknowledged a donation of fossils from the Museum of Practical Geology. Lord Brougham and Mr. Charles Dickens had been elected honorary members. The proceedings in the Industrial Department had been of considerable importance. A proposition had been made to affiliate the Institute to the University of London, so that students of the Institute passing the requisite examinations might be able to graduate in that University; but, from a variety of reasons, it seemed premature to make the application. A scheme had lately been promulgated by the University of Oxford, and an examination would probably be held in Birmingham at Midsummer next; but as none but youths under eighteen years of age would be permitted to compete, it was feared that not many of the students of the Institute would be able to take advantage of it. The report then proceeded to allude to the Institute's own examinations, and to the prizes given by Lord Hatherton, Mr. John Cornforth, and other members of the council, and referred to the fact that Lord Brougham had presented a copy of his works to be given as prizes in the industrial department. The teachers' board had been requested to report upon the question of certificates and prizes, with the view of fixing some standard for the examinations; and the matter would require careful consideration in connection with the schemes of the Society of Arts and the University of Oxford. The Latin class had been abandoned in consequence of the small number of pupils and the difficulty of securing a regular teacher. On the other hand, a class had been formed for practical chemistry, which supplied a want long felt by chemical students. Although the department was not yet quite self-supporting, its state was on the whole very encouraging, as appeared from the reports of the teachers. Exclusive of the attendances at the penny lectures and the penny arithmetic class, the number of students on the books at the close of the autumn term was 396. More teachers were urgently wanted, and the members could render the Institute no more important service than by giving their assistance in the conduct of the classes. Having alluded to the lectures delivered, the report went on to say that Mr. Williams's classes having suffered from a want of scientific apparatus, the Council purchased from Mr. Addams for £85 a set of apparatus for the illustration of optics and heat. The Board of Trade Department of Science and Art promised to contribute two-fifths of the sum, and the rest was raised by private subscription. The accounts for the past year, which had been made up to the 30th November last, had been duly audited. The financial condition of the general department was very satisfactory. Comparing 1856 with 1857, the receipts from subscriptions had risen from £282 to £433 13s.; and the lecture admissions from £50 8s. to £86 4s. 6d. On the whole the income had exceeded the expenditure by £114 12s. 2d.; but this had to be reduced by £5 3s. 4d., being the excess of expenditure over income in the industrial department. This department has been so nearly

self-supporting that the Council could not but congratulate the members upon the result. The class fees had increased from £183 14s. 4d. in 1856, to £194 1s. 1d. in 1857. The amount received from the penny lectures had somewhat fallen off. The Council regretted that the position of the building fund was not equally favourable. The total amount of new donations received in 1857 was £641 3s. 6d., including £100 from Prince Albert, a second donation from the president, Lord Hatherton, and £61 6s. 4d., which was kindly presented by some gentlemen connected with the proprietary school, being the proceeds of a ball held for the benefit of the Institute. A considerable sum had also been obtained by the zealous labours of several gentlemen in canvassing some of the wards of Birmingham. The amount already expended upon the building, in the cost of the Act of Parliament, in the purchase of the outstanding interests in the property conveyed by the Town Council, and in preliminary and other expenses, was £11,241 1s. 7d. To meet the amount which would become due upon engagements already entered into, and to provide furniture and fittings, it would be necessary to raise a further sum of at least £5,000. The meeting was afterwards addressed by Mr. Brooke Smith, Mr. J. S. Wright, Mr. Langford, Mr. W. M. Williams, and Mr. Kenrick. Alderman Manton moved a vote of thanks to the President and Council, which was seconded by Mr. Heaton, and passed amidst applause. On the motion of Mr. T. Martineau, seconded by Mr. W. R. Lloyd, thanks were voted to the teachers.—The Chairman said it might be interesting to state that the aggregate attendance at the classes was 2,250, and at the penny lectures 7,218. He thought that the want of systematic attention to the classes was the rock on which such Institutions generally split.—Mr. Smith then moved that Lord Ward be requested to accept the office of President for the year, which was seconded by Mr. T. Williams, and agreed to.—Mr. P. Hollins suggested that although the scruples of Mr. Ryland to continue in office were very great, he hoped the meeting would overcome them. He therefore moved that Mr. Ryland and J. B. Hebbert be appointed vice-presidents.—Mr. H. Wiggin seconded the resolution, remarking that if it had not been for the exertions of Mr. Ryland, the building would not have been in existence. The motion having been agreed to, the election of other officers took place, and the meeting separated.

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
Architects, 8.
Entomological, 8. Anniversary.
Geographical, 8½. I. Reports on the Expedition up the Niger, by Dr. Baikie, R.N., and Mr. May, R.N. II. Further particulars of the progress of the British North American Exploring Expedition, as far west as long. 109° on the Lower Saskatchewan, by Captain Palliser. III. Journey from Little Namaqualand eastward along the Orange River, the Northern Frontier of the Colony, &c., with Map, by Mr. Robert Moffat.

TUES. Royal Inst., 3. Prof. Huxley, "On Vegetable Life."
Meteorological, 7.
Civil Engineers, 8. Mr. T. S. Sawyer, "On Self-Acting Tools for the Manufacture of Engines and Boilers."
Med. and Chirurg., 8½.
Zoological, 9.

WED. Society of Arts, 8. Mr. J. G. Crace, "On the Use of the Soulages Collection of Italian Art in modern Art Manufacture."
Archæological Asso., 8½.

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.

FRI. Royal Inst., 8½. Mr. W. R. Grove, "On Molecular Impressions by Light and Electricity."

SAT. Royal Inst., 3. Mr. C. R. Bloxam, "Chemistry of the Elements."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Jan.* 15, 1858.]

Dated 18th September, 1857.

2428. George Edward Dering, Lockleys, Hertford—Improvements in laying down electric telegraph cables, in obtaining soundings, and in ascertaining the position of and raising submerged electric telegraph cables and other bodies.

Dated 30th November, 1857.

2980. Jean Baptiste Couy, Nantes—Improvements in the manufacture of manure, and, for the disinfection of animal and vegetable matters.

Dated 9th December, 1857.

3045. Charles Westendarp, jun., Mincing lane—Preparing a material as a substitute for ivory, which he proposes calling "artificial ivory."

Dated 17th December, 1857.

3095. Montague John Turner and Marcus William Turner, Woodcote, Surrey—The improvement of conduit pipes and tubes for sewers, drains, conduits, gas, and other purposes.
3096. Francis Mollett Blyth, Norwich—Improved apparatus for cutting and pulping turnips and other roots.
3097. William Blizzard, 14, Victoria-terrace, Notting-hill—Improvements in the treatment of india rubber by a new process for the manufacture of a chrystalline and colourless varnish for waterproofing all kinds of textile fabrics and papers, without smell and without in any degree altering their appearance, and for making divers varnishes and paints.
3099. Mark Mason, Dukinfield, Chester, and Thomas Markland, Newton, near Hyde—Improvements in machinery or apparatus for printing.
3101. Edward Highton, Regent's-park—Improvements in electric telegraphs.
3105. John Henry Johnson, 47, Lincoln's-inn fields—Improvements in lubricating the journals of shafts and spindles. (A communication.)

Dated 18th December, 1857.

3107. Joseph Bennett Howell and John Shortridge, Sheffield—An improved mode of rolling steel for springs.
3109. David Bowlas, Reddish, Lancashire—Improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.
3113. James Murdoch Napier, York-road, Lambeth—Improvements in letter-press printing machines.

Dated 19th December, 1857.

3115. Thomas Newey, John Corbett, and William Henry Parkes, Birmingham—A new or improved method of treating or coating steel pens and pen holders, to prevent the oxidation of the same, which method of treating or coating may also be applied to other articles of iron and steel.
3119. William Walker, Leeds—An improved apparatus for the purposes of heating and drying.
3121. Richard Archibald Brooman, 166, Fleet-street—Improvements in lime kilns, and in apparatuses employed for working the same. (A communication.)
3123. Thomas Coles, Bristol—An improvement in chaff cutters.
3124. William Bough, 1, Jewin-crescent, Cripplegate—Improvements in lamps and wicks for burning resin and other oils and fluids, parts of which improvements are applicable to Argand gas burners.
3125. Robert Mushet, Coleford, Gloucester—Improvements in the manufacture of iron.

Dated 21st December, 1857.

3129. William John Kendall, Norwich—An improved safety signal for railways.
3131. Francis Taylor, Romsey—Improvements in closets or privies.
3132. George Tomlinson Bousfield, Loughboro'-park, Brixton—Improvements in machinery used in the manufacture of springs, and in the application of springs to carriages. (A communication.)
3133. William Henry Myers, 202, Whitechapel-road—An improved coffee pot, made of metal or earthenware, to contain coffee and milk or cream separately, the same being used as a chocolate pot, the same invention being applicable to teapots for the same purposes, made either in metal or earthenware, the same invention being applicable to table urns, and the same invention being applicable to jugs, made either in earthenware, or glass, or metal, to contain spirits and water or other liquids in different compartments.
3135. Richard Archibald Brooman, 166, Fleet-street—Improvements in breech-loading fire-arms. (A communication.)
3137. Alphonse René le Mire de Normandy, Judd-street, Brunswick-square—Improvements in apparatus used for distilling sea water on board ships and vessels.

Dated 22nd December, 1857.

3139. Arthur Challis Kennard, Falkirk Iron Works, Stirling, N.B.—Improvements in trussed iron bridges. (A communication.)
3141. John Henry Johnson, 47, Lincoln's-inn-fields—An improved signal apparatus to be attached to common road carriages. (A communication.)
2143. Orlando Greenhalgh, and Robert Hutchinson, Horwich, Lancashire—Improvements in apparatus for stirring and mixing colours for calico printing and other purposes.

3145. George Bridge, Bollington, near Macclesfield, and Job Hamer, Longsight, near Manchester—A new process or manufacture for converting woven silken fabrics or silk waste into a fibrous material fit for being spun into yarn or thread, or for being mixed with silk, woollen, cotton, or any other material to be spun into yarn or thread, and of improvements in machinery to be employed in such process or manufacture.

Dated 23rd November, 1857.

3146. Daniel Jones Crossley, Hebden Bridge, Yorkshire—Improvements in the manufacture of certain textile fabrics, called Pellones, and used for saddle covers, and in the machinery or apparatus employed therein, which improvements are also applicable for weaving other fabrics.

3147. Thomas Landi, 16, Rue de Boulevard, Batignoles, Paris, and Charles Falconieri, 20, Charles-street, Middlesex Hospital, London—Improvements for laying subaqueous electrical cables for telegraphic communications.

3149. Christopher Nugent Nixon, Ramsgate—Improvements in attaching, fitting, and securing the rudders of ships, barges, boats, and every other description of sailing or steam vessel.

3151. Joshua Moss, Thomas Gamble, and Joseph Gamble, Sheffield—An improvement in the manufacture of cast steel hoops and cylinders.

3153. Charles Norton, 3, Lancaster-place, Camden-street, Camden-town—Carriage door shields to prevent accidents arising from the shutting of railway or other carriage doors, also applicable for nursery doors, or any other doors where children may have access, or where safety from accident may be an object.

Dated 24th December, 1857.

3155. George White, 5, Lawrence Pountney-lane, Cannon-street—A semi-melodion or instrument for demonstrating musical writing. (A communication).

3156. Charles Reeves, Birmingham—Improvements in repeating or revolving fire-arms.

3157. Samuel Henry Adderley, of Birmingham—Improvements in the manufacture and ornamentation of pencil cases, penholders, reserves or cases for leads, needle cases, and inkholders and other tubular cases.

3158. Thomas Playle, Chatham—Improvements in two-wheeled carriages.

3159. George Croft, Leeas-street, Keighley, and Smith David Steel, Greengate Mills, Keighley, Yorkshire—Improvements in machinery or apparatus for combing and preparing wool and other fibrous substances.

3161. George Burley, King's-cross-road, near Halifax—Improvements in apparatus for cutting the pile of fustians and other pile fabrics.

3162. Henry Charles Fenwick Wilson and Thomas Green, Dunston—A machine or apparatus for making rivets.

3163. Henry Charles Fenwick Wilson and Thomas Green, Dunston—Improved machinery or apparatus for making rivets.

3164. Benjamin Burleigh, 26, Great George-street, Westminster, and Frederick Ludwig Danchell, 452, Oxford-street—Certain improvements in the manufacture of vessels, plates, or utensils, used for domestic, sanitory, electric, and manufacturing purposes.

Dated 26th December, 1857.

3165. Alexander Chaplin, Glasgow—Improvements in steam engines, and in the combustion of fuel.

3166. Antonio Ribeiro Saraiva, Nottingham-street, Marylebone—An improved candlestick or holder.

3167. Charles Frederick Parsons, 1, Duke-street, Long-alley, Finsbury—Cleansing and reburning animal charcoal.

Dated 28th December, 1857.

3168. Alexander Bruce, Manchester—Improvements in watches and time pieces.

3169. John Barling, Halifax—An Improved paddle for propulsion on water.

3170. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the treatment and preservation of skins, furs, wool, and textile fabrics, and in the machinery or apparatus employed therein. (A communication).

3171. H. Deacon, Widnes—Improvements in purifying alkaline lees.

3172. James Boydell, 65, Gloucester-crescent, Camden-town—Improvements in carriages propelled by steam or other power.

3173. James Wadsworth, Hazelgrove, near Stockport—Improvements in the production and management of artificial light, and in apparatus applicable thereto.

3176. John Thomas Griffiths, New Basford, Nottingham—Improvements in the manufacture and ornamenting of lace.

3177. Isaac Holden, St. Denis, near Paris—Improvements in preparing and combing wool and other fibres.

Dated 29th December, 1857.

3178. Thomas Spencer, 192, Euston-road—Improvements in the purification of illuminating or lighting gas.

3179. Henry Thompson, Liverpool—Improvements in the application or use of a certain substance as a substitute for glue, paste, cement, varnish, and other similar compounds.

3180. John Hargreaves and Joseph Hargreaves, Liverpool—Improvements in winding up watches which have not fusees or chains.

3181. Alexander Parkes, Birmingham—Improvements in joining or uniting metals.

3182. Victor Mourot, 43, Rue de Paradis Poissonnière, Paris—Improvements in furnaces for heating kilns and ovens used in the manufacture of pottery and earthenware, part of which improvements are also applicable to furnaces generally.

3183. Edwin Gomez and William Mills, New York, U.S.—An improved composition for trains or safety fusees, and similar purposes.

Dated 30th December, 1857.

3185. Frederick Oldfield Ward, 12, Cork-street, Burlington-gardens—Improvements in liberating or producing potash or soda, or both (as the case may be), from natural alcaliferous silicates, the residuum of the process being available as a material for manure, puzzolano, or hydraulic cement. (Partly a communication.)

3186. William Henry Tooth, 9, Sumner-street, Southwark—Improvements in furnaces.

3187. Francis Palling, 134, Princes-road, Surrey—The construction of candles, lamps, and candle-lamps, without wicks.

3188. Tempest Booth, Manchester—Improvements in the treatment of certain vegetable matters, and in the application of the same to sizeing, stiffening, dressing, and finishing textile materials, and which is also applicable to thickening colours for printing.

3189. James Darsie Morrison, Edinburgh—Improvements in effecting surgical and medical operations by the agency of artificially induced anæsthesia.

3190. John O'Neill, Liverpool—Improvements in apparatus for communicating betwixt the guard or passengers and the engine-driver on railway trains.

3191. Alfred Vincent Newton, 66, Chancery-lane—Improved machinery for cutting corks and bungs. (A communication.)

3193. Richard Harmer, Union-street, Spitalfields—Improvements in cigarettes.

Dated 31st December, 1857.

3194. Carl Buhring, 91, Pratt-street, Camden-town—Improvements in the combination of carbonized and carbonizable with other materials, and the manufacture of such compounds into various useful articles.

3195. Henry Hanson, Stockport—Improvements in the manufacture and finish of cotton-band, twine, rope, cordage, and other fibrous substances, and in machinery or apparatus employed therein.

3196. Peter William Barlow, 26, Great George-street, Westminster—Improvements in the permanent way of railways.

3197. Augustin Julien Michel Ramar, 49, Broad-street, Golden-square—Improvements in ornamental and portable fountains.

3198. George Wilson, Sheffield—Improvements in the furnaces or fire-places of steam boilers. (A communication.)

3199. William Middleship, Grove-terrace, South-grove, Mile-end—Improved machinery or apparatus for obtaining motive power.

3200. James Long, Gorleston, Yarmouth, Norfolk—Improvements in the construction of sewers, and in the means of discharging the contents thereof.

Dated 1st January, 1858.

1. John Henry, Friday-street—Improvements in weaving fabrics for ladies' dresses and petticoats.

3. Louis Joseph Arsené Brun, Paris—Improvements in instruments for measuring angles, applicable to nautical and other purposes.

4. George Gorle, Handsworth—A new or improved service-box for water-closets.

5. Alexander Parkes and Henry Parkes, Birmingham—Improvements in the manufacture of rods, wire, nails, and tubes.

6. John William Clare, Surrey-square—Improvements in steam-engines and boilers, part of which improvements is applicable to furnaces.

7. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in penholders, pencil cases, and other articles sliding in cases of a like nature. (A communication.)

Dated 2nd January, 1858.

8. Robert Harvey, Glasgow—Improvements in steam hammers.

9. Archibald Slate, Adelaide-road, Haverstock-hill—Improvements in apparatus for supplying fuel to blast furnaces.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Dated 1st January, 1858.

2. James Murphy, Newport, Monmouthshire—Improvements in wheels used on railways.

WEEKLY LIST OF PATENTS SEALED.

January 15th.

1996. Richard Bolton.
2041. Nicolas Saintaird.
2165. Paul Emile Laviron.
2253. Alfred Vincent Newton.
2317. William Edward Newton.
2324. William Edward Newton.
2680. Robert Atkinson and Thos. Brearey.
2923. Thomas Glover and Alexander Bain.

January 19th.

2025. W. Hudson and C. Catlow.
2027. Charles Norris.
2029. James Burrows.
2035. F. Oetzmann & T. L. Plumb.
2161. William Edward Newton.
5383. Alexander Gray.
2507. William Edward Newton.
2593. William Edward Newton.
2819. Henry Bessemer.
2849. Edward Halliday Ashcroft.
2945. Antoine and Jean Martin.

Patents on which the Stamp Duty of £50 has been Paid.

January 12th.

85. Christopher Turner.
95. Gustav Warnecke.
231. Henry Davis Pochin.

January 13th.

114. James Lee Norton.

January 14th.

106. George Riley.
115. Jonathan Saunders.
116. Jean Antoine F. V. Oudin.

January 16th.

129. Constant Jouffroy Dumery.

Journal of the Society of Arts.

FRIDAY, JANUARY 29, 1858.

NOTICE TO MEMBERS.

Owing to a mistake on the part of the printer, in enclosing a map in a portion of the stamped edition of last week's *Journal*, a charge of 8d. was made by the General Post Office; in consequence of which the Journals have, in many instances, been refused by the individuals to whom they were addressed. Steps have been taken, at the cost of the printer, to supply the *Journal* in each of those cases, so that there may be no break in the volume. Members who have not received their Journals should apply to the Secretary of the Society of Arts, Adelphi, London, W.C.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of Inventions.

Persons intending to contribute to the Exhibition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.

2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings must be framed.

SPECIAL PRIZE.

A Prize of Twenty Pounds and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award:—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATIONS—LOCAL BOARDS.

A Meeting of the Secretaries of London Institutions in Union with the Society, was held on Thursday, the 21st inst., at the Society's House, convened in accordance with the resolution passed at the Conference held on the 11th inst. A Deputation from the Council attended the meeting, when it was resolved unanimously—

"That the Secretaries present having heard the explanations given by the Council in reference to the formation of Local Boards, undertake to report the same to their respective committees, and will, as early as possible, communicate to the Society of Arts whether they will appoint local Boards themselves or join others in the neighbourhood in doing so."

THE SMOKE NUISANCE.

Members of the Society will be glad to learn that the award made by the Council in 1856, of the Society's Gold Medal to Mr. Charles Wye Williams, for his "Essay on the Prevention of the Smoke Nuisance," has been confirmed by the Newcastle Coal and Colliers' Association, who have awarded to that gentleman the premium of £500 for an Essay on the same subject. The details of the award will be given in a future number.

There were one hundred and three competitors.

SIR JOHN SOANE'S MUSEUM.

The Trustees have given notice that the Museum, 13, Lincoln's-inn-fields, will be open this season as usual, on the Tuesday in each week, from the 2nd of February to the 31st of August, and likewise on Thursdays and Fridays in April, May, and June.

Cards of admission to view the same are to be obtained on written application to the Curator, at the Museum, or to either of the Trustees.

EXAMINATIONS.—FORMATION OF A LOCAL BOARD OF EXAMINERS AT BRIGHTON.

On Friday, the 22nd instant, a meeting for the consideration of this subject was held at the Town Hall. The desirability of forming such a Board at Brighton having occurred to some of the friends of education, a preliminary meeting was held in December last, which resulted in the formation of a Committee, at whose request a deputation from the Society of Arts attended at the Town Hall, to explain the nature of the movement. The deputation consisted of Mr. Wentworth Dilke (Chairman of the Council of the Society of Arts), Sir Thomas Phillips, Mr. Harry Chester, and Mr. William Hawes. There were present, in addition, the Mayor (J. C. Burrows, Esq.), Dr. King, Dr. Allen, Rev. S. R. Drummond,

Rev. J. Allen, Messrs. Peto, Rickards, Penley, Scott, J. Ellis, Sleight, Harris, C. Turrell, Brigden (who represented the Athenæum), Howell (representing the Mechanics' Institution), Andrews, Wonfor, and Barclay Phillips (who acted as Hon. Sec.). Messrs. Button and Wells also attended by invitation from Lewes. Similar invitations had been issued to the Institutions at Chichester, Shoreham, Worthing, and Hastings. The two former had replied that they were not yet in a position to move in the matter, and the two latter had not replied at all.

After some preliminary proceedings,

Mr. Chester explained the nature of the Society's scheme. The education given to the children of the poorer classes and those immediately above that rank, was, he observed, necessarily defective, inasmuch as they were removed from school about the time that a rich man's children were beginning to be sent there. It seemed most desirable, therefore, that some steps should be taken to complement this school-education, and this the Society of Arts had undertaken to do through the medium of Mechanics' Institutions and similar bodies. Hitherto those Institutions had not worked satisfactorily in an educational point of view. It had been found impossible to induce persons employed during the day to attend the evening classes in any large numbers, perhaps because so little inducement beyond that of mere self-culture could be held out to them to do so. The Society of Arts had now stepped forward, with the view of offering the necessary inducement, by organising public examinations of such of the students of those classes as chose to compete, and awarding to them not only certificates of approval, but also prizes, and to a certain extent, nominations to employment in the Civil Service. This system had been for some years in operation by the Society, but only to a limited extent. Thus, in 1856, only one examination took place, and that in London; in 1857, two centres of examination were arranged, London and Huddersfield, and though the examinations were satisfactory, the result was very limited, as in the last year only thirty-seven Institutions were represented. This induced the Society to return to their original design, and to have the examinations conducted throughout the country wherever co-operation could be obtained. The plan had already been carried out to a great extent in the north, and in Hampshire and Wiltshire, and there appeared no reason why Sussex should not co-operate with the Society, Brighton being the head-quarters of the union. Hence this meeting. It would be necessary to say a few words in explanation of the system of examination, which was the same throughout the country. It was obviously impossible that the Society of Arts could conduct the examinations in so many distant parts orally; therefore, it had recourse to paper-work, as at the Universities. They, however, contemplated a preliminary oral examination, the whole process being as follows. Any institution wishing to have its candidates examined will communicate to the Local Board, which may comprise any number, from one upwards. Thereupon the candidates will be submitted to an elementary examination, to ascertain whether they have a knowledge of reading, writing, arithmetic, geography, and so forth, so that the Society may not be flooded with people absolutely ignorant of everything. Questions will then be put on the special subject for which the candidate goes in, so that it may be ascertained, not how much he knows, but whether he knows anything about it. The Local Board, having gone so far, will send up to the Society a list of the "sifted" candidates and their subjects, which must go in five weeks before Whitsuntide, as Whit Monday and Tuesday are selected for the examinations in London, as most convenient for the working-men. The list will be given to the Board of Examiners, who will send down printed papers showing what the candidates are required to do, and this will be done in a room at one time, under the supervision of one or more of the Local Board. The papers returned to London will go before the Examiners, who will announce the result to the Council of the Society, and they will award certificates and prizes at meetings to be held for the purpose in various provincial towns, the Society contributing toward the expenses of those who choose to proceed to those towns to receive the awards. It was at first proposed to confer on the most successful candidates the title of Associate of the Society of Arts, but it was thought that it was not the proper course for such a Society to take on itself to confer degrees like the Universities, and happily just at this time Oxford and Cambridge had come to the determination of admitting qualified persons to share certain distinctions which would indeed be an honour to those who acquired them. Mr. Chester further explained how evening classes and other means of education could be brought into co-operation with the Society, and concluded by observing that what he proposed was easy to be done, and as it was so easy he hoped it would be done, so that the poorer classes of this neighbourhood might not be without an advantage which might thus be brought within their reach.

Dr. King was desirous of knowing something about the Society of Arts itself; and

Mr. Dilke went into some details concerning the Society, which, professing to deal with Arts, Manufactures, and Commerce, embraces subjects almost endlessly diversified.

Mr. B. Phillips wished to know in what manner Local Boards had been formed elsewhere, and in what way they had paid their expenses?

Mr. Dilke said, at Sheffield the Mayor called a meeting of the Committees of the four Institutions there, and they appointed a Committee of two or three from each Society, who will select the Examiners,—gentlemen of the neighbourhood, who will act gratuitously. He did not see how the expenses of the Local Board could exceed a few shillings, but as yet they had no experience in this matter.

The Rev. J. Allen wished to know how they were to determine the class and condition of persons intending to become candidates?

Mr. Chester read rule 17, restricting candidates.

"No person who shall not have been, for three months previously, a member of, or Student of a Class in, an Institution in Union with the Society; no person under sixteen years of age; no graduate or undergraduate of any University of the United Kingdom; no student of any of the learned professions; no certificated schoolmaster or pupil-teacher."

Mr. Hawes explained that the condition of three months' membership only applied to examinations before the Society; the Local Boards need not insist on that; indeed, the desire was to extend the benefits of the system as widely as possible. The Society had been open to a charge of trying to get up a Board of Education, which might in due time be transferred to Government; it had been said that this was a species of centralisation. So far from this, their desire was to establish the system of distinct preliminary examinations, and then, as soon as possible, that the counties should combine and have their own higher examinations also, for it would be difficult for the Society, as its operations enlarged, to undertake the work of the whole kingdom.

Sir Thos. Phillips spoke on the benefits which working men were likely to derive from the encouragement to self-education which the Society was enabled to hold out to them.

The Rev. J. Allen was sure he represented the feelings of the meeting when he said they were quite satisfied with the explanations they had heard, and fully acknowledged the kind and benevolent views which had actuated the gentlemen who had so kindly responded to their wishes in coming to Brighton this day. It was necessary to take a practical course, and therefore he would simply propose, "That a Local Board of Ex-

aminers, in connection with the Society of Arts, be formed in Brighton."

Mr. SLEIGHT seconded.

Mr. ANDREWS, Dr. KING, and Mr. J. ELLIS supported.

Some conversation ensued, in the course of which Mr. Chester stated that several appointments in the Civil Service had been already placed at the disposal of the Society for 1858, and they might have others. In the department to which he belonged, under the authority of Lord Granville, eight or ten clerks had received their appointments in this way; there were none more conspicuous for intelligence, industry, and modesty, or who, in every respect, made better public servants. The resolution was carried.

Subsequently the meeting adopted a second resolution, adding Messrs. Savage, Bessant, Brigden, Howell, and Sleight, to a Sub-Committee already formed, with a request that they would draw up a scheme for the formation of a Local Board, and submit it to a future meeting of the existing Committee, to which were also to be summoned the members of the Committees of the Royal Literary and Scientific, the Athenæum, the Mechanics', and the Railway Institutions, so that the Board might finally be established with the sanction of all the Local Societies.

The proceedings closed with votes of thanks to the Deputation and the Chairman.

EIGHTH ORDINARY MEETING.

WEDNESDAY, JAN. 27, 1858.

The Eighth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 27th inst., Peter Graham, Esq., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Burt, Frederick Valentine	Piesse, G. W. Septimus
Clay, William	Scott, Wentworth Lascelles
Hodgson, Rev. William	Underwood, John
Johnston, James	Watson, J. Forbes, A.M., M.D.
Manning, Frederick A.	Waugh, John Neill, M.D.
Morgan, Thos. Vaughan	Young, W. Hill.
Morgan, Wm. Vaughan	

The following Institution has been taken into Union since the last announcement:—

453. Richmond (Surrey) Young Men's Institute.

The Paper read was:—

ON THE USE OF THE SOULAGES COLLECTION OF ITALIAN ART IN MODERN ART MANUFACTURE.

BY J. G. CRACE.

I think that the subject I bring before your notice can be discussed in no place more appropriately than in this; and that it is also one peculiarly suitable for our consideration. In no possible manner can we more usefully advance the interests of art manufacture than by seeking to acquire collections of works that have impressed upon them the genius and the skill of men who lived at a time when Art abounded.

You may teach the rules of Art, which serve like grammar to a language, but, without examples, it will be difficult (perhaps with few exceptions, impossible) for students to arrive at anything like perfection in the arts of design by rule alone: "Longum iter per precepta, breve et efficax per exempla" is indeed a true saying, inscribed by Lord Bacon in his house at Gorhambury.

I will preface what I am about to say respecting the "Soulages Collection" by a reference to Art Manufacture, as it existed about the time that these examples were produced; for they are mostly of a period ranging from 1500 to 1600.

At this date society had just emerged from that chivalric barbarity which prevailed during the Mediæval period, which recognised the pre-eminence of brute force or military skill, rather than the refinements of literature or the arts. Commerce, too, that greatest of civilizers, now vastly extended its ramifications, and bringing wealth and more genial desires for comfort or luxury, caused a general appreciation of Art, and a greater desire for obtaining its productions. Then began to burst forth in Italy that revival of a love for Art which had almost slumbered on the dry rules of tradition for so long a period; and then successively arose those great artist minds that brought such glory upon their country and their time.

Nor was it the higher branches of art, Painting, Sculpture, Architecture, that alone were exalted; but the more ordinary objects of daily use were equally affected by this growth of art. Metal work, pottery, glass, furniture, woven fabrics, all became the medium for exercising the taste that abounded, and which was demanded by that love for art which had so strongly inoculated the minds of the people.

And what a strong spirit, what a knowledge of and love for art had this revival, this "renaissance" of art, produced! At no other time do we find such fancy, originality, and beauty, so abundantly exhibited in common things, as in the art manufactures of this period. Take up what specimen we may, we find something to admire and something to learn from. It is a period, of all others, valuable for instructing us in those fanciful combinations of ornamental art, a knowledge of which is so essential in art manufacture.

Most valuable to us, therefore, must be a collection of objects precisely of this kind, a collection affording characteristic examples of each branch of manufacture. Such is the Soulages Collection, of which I now propose to speak in detail.

You are aware that it consists of specimens of pottery, such as Majolica ware, enamelled ware, and stone ware; of enamels, of glass, of metal work, of sculpture, of painted glass, of pictures, of tapestry and woven stuffs, and of furniture; numbering nearly 800 pieces.

This collection was formed by M. Soulages, about twenty years ago, specially with the view of illustrating the arts of the sixteenth century, and more particularly those of Italy. He travelled to that country, and selected the specimens with great taste and judgment, under circumstances far more favourable than are likely again to present themselves; for the actual value of this class of art works is enormously increasing. It was known to many in England that this curious collection existed; and when an opportunity of acquiring it offered, it was justly considered that it ought to be purchased for this nation. Then, however, the energies of our Government were directed upon the Russian war, and Ministers could not bestow thought or money on this subject. Several lovers of art, however, met together, and guaranteed a sum of money which enabled them to purchase the collection, in the hope that in more quiet times it might be acquired by our Government for the public benefit.

The most important part of this collection is undoubtedly that comprising the specimens of Majolica ware, whether on account of their number (167 pieces), or their mercantile value. Of no intrinsic value for the material itself, which is generally of a coarse description, they are priceless for the art displayed upon them, and most curious as examples of the various processes employed.

Most beautiful are the delicate arabesques which are interwoven on their surfaces, drawn with such fancy and taste, and arranged so skilfully.

Look at them as the works of men who, of great talent

in high art and overflowing with the love of it, thought not that they descended when they exercised their genius in adorning such lowly things.

Of the highest interest to the manufacturers of earthenware and porcelain, their value is by no means limited in that direction. In every branch of manufacture where the art of design is required, they are a mine of art-wealth, full of suggestions for ornamental design, or arrangement of beautiful colour; while their contemplation must ever exercise a beneficial influence in improving taste, and causing a keener appreciation of its value.

Decorative pottery was introduced into Spain by the Moors, and by them the manufacture was carried on to a considerable extent, and large quantities were imported into Italy during the middle ages. Early in the 15th century the manufacture of this peculiar ware was introduced into Italy, probably by some of the Hispano-Moors who were driven from Spain.

It is well known that at the Alhambra there is a vase of large size and of rich and beautiful Moorish design in gold and colours; and throughout that palace the Moorish tiles still remain on the dados and other parts. At Seville, in the Moorish palace called the "Alcazar," there are to be found the "Azulejos" or enamelled tiles, and there is also in this city one palace, called the "Casa de Pilatos," belonging to the Duke of Medina Celi, in which the walls of all the state apartments are covered from top to bottom with tiles of the most elegant patterns of about 16th century work. I made drawings of several of these; and, feeling sure I could not do better, gave them to Mr. Minton, who has had one of them made, which I now show you.

The Moors excelled in this kind of pottery, and were especially celebrated for giving to it that iridescence or coloured lustre, which is one of the peculiar qualities of the Majolica ware.

There has been considerable diversity of opinion as to the origin of the term "Majolica," and it has been most generally stated that it derives that name from the island Majorca. It occurs to me, however, that it is certainly derived from the Arabic word "Majar," brightness or splendour; and "lejo," which I presume to correspond with our word "ware," as in the Spanish name for tiles "Azulejos," equally of Arabic origin, from "Azu" blue, and "lejos." I advance this derivation; others better qualified than myself will test its correctness.

During the 15th century the Majolica ware became a great staple manufacture of Italy, and brought renown upon the towns where it was manufactured—Faenza, Urbino, Castel Durante, Gubbio, and Pesaro. The master whose name is attached to the most important pieces is Maestro Giorgio Andreoli, better known as simply "Maestro Giorgio," of Gubbio. He had a son Vicentio, called Maestro Cencio, who followed his father's profession. It is more especially these masters who excelled in the iridescent or "lustre" colours, for which this ware is so celebrated. Orazio Fontana and Francesco Xanto, both of Urbino, also produced works rivalling in beauty those of Giorgio.

Among the specimens to be particularly noticed, the vase No. 95 of Hispano-Moorish design, is curious both from its rarity and the peculiarity of its form and pattern, which the photograph will explain. Its height is 20¾ inches, and the pattern on it is formed of leaves and stems in yellow lustre and blue enamel on white.

The large plateau No. 2, of which there is also a photograph, is to be remarked for the brilliancy of its glaze, and the richness of the arabesque ornaments which form its borders.

No. 4 is a plateau remarkable for the beauty of its lustre, of a delicate pale rose colour.

No. 9 is a magnificent example of richness, of colouring, and beautiful execution. The medallion head is on a deep blue back ground, and is supposed to be a portrait of Perugino.

The plateau No. 11 is an example of painting of a high class devoted to this ware. The whole surface is covered with the subject of the "Gathering of the Manna," from an engraving after Raffaelle. Not only were paintings copied, but artists of reputation designed expressly for it, as this drawing, lent by Mr. Robinson, will show. This is a design made for a plateau by Battista Franco.

No. 22 is a large plate of Gubbio lustre ware, by Maestro Georgio, dated 1522. The photograph will convey some idea of the richness and beauty of the ornament. It is painted on a blue ground, and richly relieved with the ruby and yellow lustres, exhibiting a perfect blaze of the most brilliant "reflet."

No. 88 is a small oviform ewer of Urbino ware, attributed to Orazio Fontana; an exquisite piece, possessing all that is beautiful in the various peculiarities of this ware, and equal to any production from Sèvres or Dresden.

Nos. 92 and 93 are a pair of oval flasks of Urbino or Castel Durante ware. The photograph will show the elegant form and ornamentation of these specimens. The arabesques are in colours on a white ground.

No. 131, a candlestick, Gubbio lustre, is a very beautiful example, adapted, as regards its ornament, from the bronze damascened candlesticks of Oriental workmanship, so frequent in Italy at that period.

It would fatigue you were I to attempt to describe all that is beautiful in this collection; and besides, it would be useless, for the interesting catalogue raisonné by Mr. J. C. Robinson, gives a perfect account of everything.

Next we have 23 pieces of Palissy ware, or ancient Faience of the south of France. This varies from the objects last under our consideration, being ornamented in relief, and painted in enamel colours of great brilliancy. Bernard Palissy was the originator of this kind of art. He enthusiastically worked out his inventions under extraordinary difficulties, till he arrived at results enabling him to produce the beautiful works which established his fame.

These are divided into three classes. 1st, the rustic pieces, being mostly dishes, decorated with foliage, reptiles, &c.; 2nd, those with relief of figures; 3rd, pieces with ornament only.

The Soulages Collection contains specimens of each of these styles.

The large oval dish, No. 134, is a beautiful specimen of the first kind. All those reptiles, and fish and plants (which are given rather confusedly in the photograph, on account of the colours), are in the original carried out with the most perfect imitation of nature. Still, I consider this a kind of work curious for the invention of its enamel and other technical qualities, rather than for general usefulness as applied to art. Far different is the next piece that I shall notice, No. 144; an oval ewer, which is of infinite elegance of form and decoration; it is a model worthy of the notice either of the goldsmith or modeller of pottery. Its extreme height is 11 inches, and the length 8½ inches. The photograph will show the excellence of its outlines. The medallion in the centre contains a water-nymph; the ornament, of various colours, is on a rich blue ground.

The collection contains also some specimens of Flemish stoneware, and lastly, but not least, two specimens of Della Robbia ware, both of great beauty, as will be evident on looking at the photographs. One is the Virgin and Child, a circular relievo, 21 inches in diameter. The back ground is blue, the figures white enamel. The expression of the faces is most holy and beautiful. The other specimen, "The Adoration of the Wise Men," 24 inches long by 16½ high, is also an exquisite production.

The inventor of this ware was Luca Della Robbia, born about 1400; he was assisted by his nephew, and the art was carried on by their descendants till about the year 1567, when it dropped. The ware is modelled in terra cotta, covered with an enamel glaze of a similar composition to that of the Majolica ware.

The collection of Venetian glass contains 90 pieces, remarkable for great variety of form and technical excellence in workmanship, evincing great originality and beauty, and particularly valuable to our workmen in glass, as giving very many examples worthy of imitation and study; in fact, I fear that our working glass-blowers have scarcely any ideas of artistic outlines, and have great need of being familiarised with such forms as these. Our glass is beautiful in colour, excellently cut, expensively got up, but how very little of it can be commended for form. Of late, however, I have noticed specimens which show great improvement in this respect, and if our workmen have opportunities of seeing what is good, I doubt not they will soon appreciate it.

The manufacture of Venetian glass was carried on at Murano, an island adjacent to Venice, and here has originated or been carried out all that is curious and beautiful in glass from a very early period, such as the Laticinio or filagree, those delicate web-like spirals; the vitro di trina or lacework glass; the millefiori eccentric patterns of various colours, also glass enamelling and gilding. It was also here, if I do not mistake, that glass mirrors were first made.

Next we have to consider the specimens of enamels of Limoges, of which there are 25. These are mostly plaques, containing historical subjects or portraits; some by Léonard Limousin, and are very desirable, because these productions are limited in quantity and difficult to be obtained. Till very recently this art of enamelling has, I believe, never been carried on to any extent for decorative purposes in England, but I think it is a very tasteful and beautiful form of ornamentation, applied either to metal work or furniture, and likely to be far more extensively employed than has hitherto been the case; therefore, I say, collect good specimens of it wherever they present themselves, for how can workmen be instructed, unless you have examples to show them what can be done.

The specimens of ornamental metal-work number about 100. They give examples of brass and bronze casting, engraving, and damascening of the Cinque-cento period. Most of these are of a class meriting careful study by our designers and workmen, for this is a branch of art-manufacture in which we are sadly in want of workmen of artistic feeling, the nature of the process requiring that, after the cast comes from the mould, the finishing should be done by men who comprehend the intention of the modeller. The French bronze trade is of great importance; it employs a vast number of hands, and, besides supplying an immense home demand, exports very largely to every country where a love for art exists.

The Italians of the fifteenth century were renowned for their artistic working in metal. Who has not read the life of Benvenuto Cellini, and been delighted with the burning enthusiasm he throws into all his artistic undertakings, and the vivid picture he gives of artist life as it was in his day?

There are several very fine specimens of Italian metal work in this collection, but I will speak more particularly of those which are represented by photographs. Firstly, that beautiful door-knocker in bronze, said to be by Giovanni di Bologna, in which the figures are so gracefully entwined, so fancifully and artistically rendered. Then those brass ewers, alike elegant in form, and valuable for the art displayed upon them by the engraver; and the salver, too, covered with rich ornaments and groups of figures; more precious even are the exquisite bronze candlesticks, so elegantly ornamented with the delicate threading of silver damasquinerie, worked, I presume, after Moorish models.

There are many objects of great interest, such as the bronze fire-dogs, standing 4 feet high, rich in foliage and figures, and impressed with the arms of Barberigo of Venice; there are clocks, inkstands, saltcellars, lamps, locks and keys, and various utensils, all bearing on them the stamp of artistic minds, and most valuable as models for our study.

The collection of medals is particularly fine, and numbers above 100. An examination of these will show that the Italian artist of that day aimed at something more than a profile outline of a head; he gave it all the *vrai-semblant* features of a picture, almost the texture of the skin, a life-like look, well worthy of study by medallists of the present day.

The collection of furniture contains some interesting pieces, gems in their way, and several very curious, and useful for the suggestions to be derived from the study of them. At the time this furniture was made, people had not arrived at that appreciation of comfort and luxury which prevails at the present day; it must be studied, therefore, for its artistic quality and not servilely copied.

The furniture of houses in the fifteenth century was generally limited to objects of immediate use, such as the bed, tables, chairs, buffets for the display of plate, and chests more or less ornamented, and all of these constructed somewhat rudely. As the revival of art and literature extended its influence, the demand for ornamental furniture increased, and we find it constructed with more care, and men of talent in art designed it. Vasari tells us that Baccio d'Agnolo and his sons were celebrated as sculptors for furniture in the middle of the 16th century. Veneering, also, with rare woods was now introduced, and the re-invention of Tarsia work, or marquetry, as we now call it, allowed of very beautiful ornamentation.

This Tarsia work is the inlaying of various woods in ornamental forms, and Vasari informs us that Giuliano and Benedetto Maiano were renowned for this kind of work, and which was brought to a higher degree of perfection by Giovanni di Verona, who invented processes for shading and staining the woods.

All who visited the Soulages Collection must remember the three mirror frames represented in the photographs. What an example of art work is that circular frame said to have belonged to Lucrezia Borgia; how admirable is the carving of the delicate scroll blended with figures and animals typical of good and evil. Then the square frame mirror of such fine artistic design and masterly execution. And, thirdly, that elegant frame fitted to a stand so simple and beautiful, so exquisitely detailed in the carving. This belonged to the famous Malatesta, Lord of Rimini. Such works as these inspire an art workman to rise above common things, to be dissatisfied till his hand acquires a higher touch of art than it had before.

There is another mirror frame in ebony of refined and quiet taste, inlaid with lines of ivory gracefully interlaced. The series of chairs is very curious, particularly the folding X chairs of the ancient curule form. Several of them are represented in the photographs. They approach very nearly in style to the gothic, but the transition to more modern ornament is perceptible. There are four other chairs of this form which are remarkable for their beautiful inlay in geometrical mosaic work of ivory and light woods on walnut ground, and are wonderful for their perfect finish and workmanship. They must have belonged to one of the Dukes of Urbino, as the device of that family is represented on each of them.

There are many other chairs of various designs, some very peculiar in form and elaborately carved, as can be seen in the photographs, which also give the designs of the two richly carved coffers or chests, such as it was usual in those days to present to a bride with her *trousseau*. These coffers were generally the work of sculptors of repute. I refer you to the photographs for representations of various tables, buffets, dressoirs, and cabinets, more especially the one numbered 690, which is ascribed to Bachelier, a sculptor and architect, of Toulouse, of about 1550, who had a great reputation for works of this kind, and is said to have been a pupil of Michael Angelo. This cabinet is highly decorated, and is ornamented with inlaid woods.

I must not omit to mention the superb lanthorn, from

the Gradenigo Palace at Venice, a magnificent example of cinque-cento work of bold and artistic design, worthy of careful study.

The series of tapestries are interesting, being of a very early date and uncommon style, and the woven and embroidered hangings are very useful as patterns, which deserve particular notice by our designers.

There are various other objects in this collection to which I think I ought to have directed your attention, but I am fearful of going too much into detail, and wearying you with a monotonous description of beautiful things. I cannot, however, allow myself to omit some allusion to the carved stone chimney piece, which is, I think, considered the most valuable object in the Soulages Collection. Its date is about 1500. The size is 7 feet 6 inches high, by about 8 feet wide. The jambs are decorated with foliage, shafts with highly ornamented consoles supporting the hood or canopy; on this is the Entablature, its mouldings richly carved, and the frieze filled with a series of figures representing subjects of hunting, all executed with the utmost skill and high finish.

Now all the fine things in this collection which I have thus imperfectly brought before your notice can be acquired for the country for the sum of £15,000. Casts of the most important specimens could then be sent to the provincial towns, and the collection itself sent occasionally. Lodged in a national museum, they would carry with them a well of knowledge most essentially valuable to us as a manufacturing nation; to each and every art trade they offer something suggestive of beauty, and, therefore, of value.

A national museum of objects of tasteful art, is a practically valuable property to the country. To raise the standard of taste, is to extend our commerce. I quote the words of the celebrated Necker, who says "Le gout est le plus adroit de tous les commerces."

Taking the productions in which art gives the element of value, let us compare the exports to foreign countries, not colonies, from our own country, with those of France, in 1855 :—

	France.	England.
Furniture	£1,000,000	Nil
Bronzes	300,000	Nil
Paper-hangings	100,000	Nil
Silks	8,000,000	£2,300,000

And in this last article of silk, if the value of the ornamented silks were abstracted from that of the plain, I fear it would give a comparison of about 20 to 1 against us.

But it does not end here. Our cotton and worsted fabrics, and many other goods, compete in many parts of the world, and the most tasteful goods must carry the best price. We cannot afford to stand still; we *must* advance.

When I look back to what Colbert—the great Colbert I will call him—did for his country in fostering art for manufacturing purposes, and consider the niggardly help given by the Ministers of our own country, I come to the conclusion that parliamentary discussion so exhausts their energies that they are unable to appreciate the importance of many subjects that act upon the manufacturing interests of our country, and of these the art of design is of the highest importance. Yet, even if they considered political interest alone, they would not be deaf to the wishes expressed from the various manufacturing cities. Some time ago I recollect reading memorials from the merchants, manufacturers, designers, and others, of such places as Birmingham, Halifax, the Staffordshire Potteries, Hull, Oldham, Sheffield, praying the Government to form a trade museum, containing examples of art works; and something has been done no doubt, but how difficult has been the process, and what a long way are we yet from attaining the sort of collection which a country like ours ought to possess! Compare it with the Hotel de Cluny at Paris, but there they have a minister whose duty it is to superintend museums of art, and to render them as complete as possible. Here we have but the beginning of a system. Certainly the President of the Council of Education was last year constituted the minister responsible for the artistic and scientific instruction to be given to the people. This minister has so little power, however, towards forming this museum, that he assured a deputation, consisting of the most eminent architects and manufacturers, who waited upon him, recommending the purchase of the Soulages Collection, that though he fully sympathised with them, and was most desirous of obtaining this collection for the country, he had no means at his disposal —the whole yearly grant, in fact, towards forming this art museum was £2,000.

The British Museum has yearly grants for obtaining objects of antiquarian interest or ancient art, to the extent of £15,000. The National Gallery has a committee who obtain large grants for doubtful pictures of high art, for £14,000. But for obtaining examples of art works applied to manufacture, we have a minister with no funds. The only resource left to us is to address ourselves to those who, like ourselves, feel the necessity of advancing the arts of design as applied to the manufactures of our country, and together raise our voices to make known to our government what we consider essential towards developing its progress.

DISCUSSION.

The following letter has been received by the Secretary:—

SIR,—Of the great importance of the Soulages Collection, and other examples of mediæval and ancient art, being secured to the nation as they occur in the market, there can be no doubt, and I am truly glad to see the subject brought under the notice of the Society, a subject that directly bears upon the arts, manufactures, and commerce, one and all; upon the arts, by placing before our artists matters of history and precedent; upon manufactures, by suggestions in colour, form, and material; and upon commerce, by improving our productions and extending our markets in quarters where we are beaten by art rivals without one tithe of our material advantages. As a whole, the Soulages Collection is most valuable, and though a judicious selection would, perhaps, enhance some specimens and deteriorate others, it ought to be taken as it is, if we are to form a creditable Mediæval Museum of Art applied to the uses of domestic life. We are a home people, and all that tends to refine that sacred place ought to gain our affections. It has been the aim of our artists to decorate the walls by putting large art in small pictures, and what we want still more is the art to put a little more extended feeling in our furniture and effects. To gain great ends we must not be sparing of our pence; if we are ever to have an "Hotel de Cluny" (and we have more than one edifice suitable in London) we must not be chary of the furniture.

I am, &c., JOHN LEIGHTON.

MR. FARRER fully agreed with the author of the paper that this was an appropriate place in which to discuss the desirability of the purchase, by the nation, of the Soulages Collection, inasmuch as in the rooms of this Society the Exhibition of Ancient and Mediæval Art had been held some years since. The importance of establishing museums as aids to art in every town of importance, and even in many of the smaller towns, had been recognised by the governments of Europe, and hence exhibitions of that kind had been greatly multiplied throughout the continent. The sum required for the purchase of the valuable collection of works of art now under consideration was so trivial, that it was to him a matter of surprise that there should be any hesitation upon the subject, because, in the present day, it was very seldom that

a collection of this kind came within the means of attainment. The result of the proverbial tardiness and reluctance of our government in matters like this, was that the English people were charged with being destitute of artistic taste. It was true that the country at large possessed two-thirds of the most valuable pictures in the world, but it was difficult to convince the English government of the necessity of securing such things as they came within their grasp, and on many occasions the most valuable specimens of art had been allowed to pass into the hands of other nations. Mr. Farrer then alluded to the purchase of the Elgin marbles. When this was made it was argued that such fragmental things could be of no value in the promotion of art, but it was now acknowledged to have been one of the most valuable acquisitions ever made for the country. Sir Richard Westmacott, in reply to an objection taken by a member of the then government, that such broken specimens could be of no value to the sculptor, said that it was from these fragmental beauties, when combined and regarded as a whole, that the finest works had been produced. He thought, in a question of this kind, it was the working man—the artisan—who ought to be mainly considered. The acknowledged superiority of the French artisan, in taste and beauty of design, had been commented upon in the paper, but the French would not have taken the lead in matters of taste if it had not been for the Louvre, the Tuileries, and the Luxembourg. At every turn in the French capital some object of beauty in the arts was presented to the eye, and the artisan unconsciously imbibed the true spirit of those works, and carried it out in his productions. The artisans of this country required no actual teaching from government; all they required was the opportunity of studying really good models in museums, and he thought it was the duty of a parental government to provide such museums. In every continental country with which he was acquainted, the government recognised the importance of providing means of artistic instruction for the people, and why should England be behind them? He strongly advocated the purchase, by the government, of the valuable collection of specimens of art which had been so ably referred to in the paper that had been read.

Professor Donaldson thought they were deeply indebted to Mr. Crace, as a manufacturing artist, for having pointed out the influence which this collection would have upon the artisans of this country in producing articles for the ordinary purposes of life. There was no doubt that we were greatly in want of really good studies, and it was only by multiplying these that the workman could be taught to apply the skill which he naturally possessed. It was useless to refer the artisan to nature alone. He must have principles to guide him. It was not enough to place before him mere leaves and animals; it was necessary that the art element should be infused into his productions. Mr. Crace was therefore quite right in saying that examples were required in order to produce a good school of art. It had been the object of France and other continental nations to introduce the finest examples into their schools of art, and hence the French had acquired their pre-eminence in artistic design. The French artist was brought under an organised system of education and training for his profession, and thus acquired the elementary knowledge and manipulatory skill which enabled him to attain such mastery in his art. He thought it was mainly owing to the schools of art maintained in France that the French artist was enabled to excel in the styles of various periods. Unless the workman was instructed upon true principles he could not produce works which would stand the test of ages, although he might satisfy the passing passion of the day. The works before them which were now so much admired, had also received the admiration of Popes, Cardinals, and Princes of Italy. Would that a similar love of art existed among our ministers in the present day. Some striking statistics had been quoted by Mr. Crace, showing the bearing of this question on our export trade in art manufactures. It was true there was a substantial character and an excellence of material in English manufactures, but the superiority of design and tasteful manipulation of the French productions, gave them the preference in the market, even at the sacrifice of real utility and excellence of workmanship. Manufacturers were obliged to go to the expense of providing their own models, and the opportunities of obtaining really valuable ones were extremely rare. If the government allowed this opportunity to pass, and permitted this collection to become dispersed, he thought it hardly possible to collect again such a number of splendid examples in various classes of art as were contained in the Soulages Collection. It would seem that our government could not appreciate the value of placing before our artisans first-class examples. They authorised their agents to go to only a certain amount in the purchase of specimens of art, and so the first-class articles were secured by private persons or foreign nations. It was remarkable how many continental towns had become great and celebrated merely from the perfection to which a particular class of manufacture had been brought there. It was true that many of the most beautiful specimens in this collection were of a class to serve none of the useful purposes of life, yet, as examples of art, they were invaluable. It might be that some of our great manufacturers were rich enough to procure a few specimens for the study of their workmen, but it was found that unless they had a large variety, a sameness of style would prevail in their productions. On these and other grounds he considered it was of the first importance that the Soulages Collection should be secured to this country, and he hoped the public would express this opinion so strongly as to give confidence to Lord Granville in urging this matter upon his colleagues.

Mr. Richard Moore said that, as a working man, he would urge the desirability of purchasing this collection—not for any special benefit that it would confer upon those similarly employed to himself, but because it would in some degree afford to the artisans of this country those opportunities which were enjoyed to a much larger extent by their brethren abroad, and would serve to develop the powers which he believed to be inherent in them. They must be aware that a few years ago there was great paucity, in this country, of examples worthy of study as works of art, and formerly the artisan was almost entirely shut out from every kind of art exhibition. Nothing appeared so desirable as to starve the mind of the working man, so that he should really possess no information on the subject of his handicraft. When the late Mr. Hume and other philanthropic members of the House of Commons exerted themselves to open the cathedrals to the public, and to add to the museums as well as to open them for a longer time, there seem to be a general disbelief on the part of the educated classes as to the value of those institutions to the working community, and it was not until the late Sir Robert Peel joined in that movement and gave it the sanction of his authority that anything practical was done in that direction; it was not until he had avowed his opinion that valuable works of art were not so much in danger of injury at the hands of the artisan as from those of the vulgar rich, that the national exhibitions were opened to the working man. In the branch of manufactures with which he was connected, they had an association, in which a small endeavour had been made to collect a library of ornament and specimens of castings which they believed to be valuable in their occupation, but their efforts only served to show how feeble were the exertions of a few individuals, in comparison with what the government of the country had the power and means to effect, if those means were only judiciously applied. No one would desire that the government should launch into an extravagant expenditure for these objects, but the manufac-

turers were called upon day by day to execute works of different styles and periods, and it was of the highest importance that they should have some means of testing the correctness of the style of work in which they were about to engage. This had been effected to a considerable extent in one department at the South Kensington Museum, where the artisan could find a rich store of instruction. What they wanted was examples which bore the stamp of genuineness and authenticity, and he was sure that museums of that character would be largely frequented by the working classes. This was a matter which ought to become the especial care of one department of the government, as was the case abroad. It was not asking the government to do anything beyond its province. The examples of this collection belonged to a period famous in the arts, and the production of similar works would be certain to create a demand for them. When they considered the rapid increase that had taken place in many departments of art manufacture, they must conclude that large opportunities still existed for enriching the country by the application of genius and energy in this direction, by successful competition in articles for which their French neighburs at present carried off the palm. There could be no doubt of the superiority of most of the productions of French handiwork. With every desire to think well of themselves, the English workmen could not but concede the palm to them in almost every department of art work; but when they compared the means of instruction at the disposal of each, the difference could easily be accounted for. The English artisan had been starved into inferiority of production by reason of the apathy of the Government, and he was certain that money to a moderate amount judiciously applied in this direction would return its full value to the country in various ways, some of the principal of which would be the improvement of the condition of the working classes, and, by the increase of our exports of art works, the benefiting to a large extent the trade and commerce of the country.

Mr. Richard Redgrave, R.A., remarked that allusion had been made to the idea that in high places the notion was entertained that this collection did not abound in really beautiful productions. It was to be remembered that in the early times of Christian art in England there was no anxiety manifested for the purely beautiful, and the art decorations of that period were for the most part confined to what was symbolical, but at a subsequent period the purely beautiful was aimed at by the artist. When they recollected the productions of Michael Angelo, Raffaelle, and others of that period, they could not but acknowledge that these masters were entirely in search of the beautiful; and they could hardly suppose that men of such calibre could err in their notions of the beautiful, or fail in their realisation. The merit of works of art must be judged of by men who had made that subject their study, and with all deference to the Chancellor of the Exchequer, he could hardly recognise him as a competent judge on such matters. He thought a great mistake would be committed by the government if they allowed this collection to escape them. Mr. Redgrave proceeded to contrast the almost feminine character of the ornamentation of modern Sèvres china with the bold and brilliant style of the specimens contained in this collection, and remarked that, had the manufacturers of that period been possessed of the superior material now employed in pottery these productions would have been of a still finer character. Ought they, therefore, for the trifling consideration of some £15,000, to allow a collection, stamped with the genius and beauty of the period at which it was produced, to be lost to this country? for then the great artists of the day did not think it derogatory to furnish their own designs for such articles; and ought they to hesitate in securing these examples of beauty for the benefit of our artizans, who were pronounced to be behind their continental brethren, and that, too, in the judgment of those who had been educated to a true appreciation of Art. He hoped the effect of this meeting would be to induce the Government to reconsider this question, and not to allow a collection like this to be dispersed and lost to this country.

Mr. E. Nash was connected with a numerous class by whom the value of such a collection as this was duly appreciated, and it was his anxious desire that it should be secured to the country. In all these cases it was found that the government held back till they were subjected to a pressure from without, and he supposed this would happen with regard to this collection. He believed the £15,000 could be readily raised by public subscription, limited to £1, and if the government failed to do their duty in this matter, he should like to see some such suggestion carried out, so that this collection might be purchased by the public at large, and deposited in a suitable building for the benefit of the country.

Mr. J. A. Rose did not agree with those who had asserted the pre-eminence of the French productions as compared with those of the English manufacturers. He fully concurred in the necessity for urging upon the government the purchase of this splendid collection in its entirety, for he thought it would be most valuable to all classes of the community. It was a collection as valuable to the educated and rich as to the working artisan and mechanic. There had been periods of a species of madness in this country, when some of the finest collections of art had been entirely lost for want of seizing the proper opportunity to acquire them. In illustration of this he might mention the magnificent gallery of pictures collected by Charles I., which, under the hammer of the auctioneer, were scattered all over the continent. He thought, if a similar course were taken with regard to this collection, the best articles would be secured by foreign agents with unlimited commissions, whilst this country, under the parsimonious system adopted by the government in reference to matters of this kind, must be content with the inferior examples. Mr. Rose added that in the event of this collection being secured to the public, he hoped that some locality more central and more easily accessible to the working classes than South Kensington would be fixed upon for its exhibition. For his own part, he should like to see a museum at Wapping.

Mr. Henry Cole, C.B., in answer to Mr. Rose, said that the question of the purchase of the collection had nothing to do with the site where it might be deposited. The purchase should be made for the instruction of all classes throughout the United Kingdom, and if, when bought, the collection should be sent to the Kensington Museum, it would then be circulated among the various seats of manufacture in all parts of the country, as was already done with the articles now in that Museum. He agreed in the opinion that the higher classes needed instruction in art as much as the working classes. When Schools of Design were first established here, they were intended solely for the benefit of the artisan, and they did not succeed very brilliantly under that erroneous aspect. After some trial of the system, he (Mr. Cole) was charged to give what aid he could in the development of the Schools of Design, and he then said that if he had to elect between the two, he would teach the higher classes to appreciate art, for they could afford to pay for its productions, and if a demand were thus created, the supply would follow. He begged to correct a misapprehension which Mr. Rose appeared to entertain with regard to the working classes not visiting South Kensington Museum. Special arrangements had been made for the convenience of the working classes, and the museum was open of an evening for their benefit. In that respect it stood alone. The number of visitors of that class had been far larger than was the case with similar establishments more centrally located; and if the present statistics continued to the end of the year he believed the visitors to South Kensington would outnumber those to the British Museum. With regard to the latter establishment they

were so cramped for room that they were at a loss how to dispose of the late importations from Greece.

A MEMBER suggested that there was plenty of room in Smithfield.

Mr. COLE would rejoice to see a good museum in Smithfield, and also one at Wapping, but the idea of a central museum for three or four millions of people was absurd. They required five or six museums, and he hoped they should have a good museum at South Kensington, and also that the National Gallery would be kept in Trafalgar-square. He desired to see a museum at Victoria-park, and they had a valuable collection of pictures at Dulwich which he hoped would be retained in that locality. After all, he thought people would go where there was the greatest attraction, regardless of the consideration of locality. They found that large numbers went to the Crystal Palace, notwithstanding its distance from London, solely because it was attractive to the public. If he (Mr. Cole) were free to act, and had sufficient means at his disposal, he would establish museums in the parks, which possessed natural attractions to the public, and he thought there would be no fear of a want of visitors.

Mr. ROUGH expressed a hope that, if this collection were secured to the public, it would be placed in some situation where the artizan could have the benefit of it. He agreed in the superiority of French productions of art over those of the English. The reason for this was, that in Paris there were constantly objects of beauty which the artisan could study and admire; the Louvre, the Tuileries, and the Luxembourg were always open to inspection. What they wanted was similar advantages in this country.

Mr. SIMPSON remarked that the important part of the question was, how the result which was so unanimously desired could be arrived at, namely the possession to the country of this collection of works of art. He hoped that some strong expression of the feeling of the present meeting would be made to the proper authorities, so that for the trifling consideration of £15,000 so truly valuable a collection would not be lost to the country.

The CHAIRMAN said it now became his duty to propose a vote of thanks to Mr. Crace for the paper he had read. He thought there could be no doubt as to the necessity of adopting all the means in their power for improving the artistic taste of the country, and he quite agreed in the opinion that there was great room for improvement in the taste of the upper classes. One great difficulty at the present time, with regard to art manufactures, was in the taste of those who were the purchasers of such articles. There was little difficulty in getting really good works executed when there was a demand for them. The alleged superiority of French art production was owing to causes too numerous for him to mention; but no doubt our great deficiency in this respect had first led to the establishment of Schools of Design. That was followed by the Copyright in Designs Act, which, however, had proved very inefficient for the purposes for which it was passed, inasmuch as the longest period of protection which it afforded to models for manufacturing purposes was three years, and in some cases only six or three months. The system of copyright in these matters in France was extremely simple, and in this respect he thought we should do well to imitate our neighbours. In France the right in a design was secured to the designer, and if anything similar was required by any other manufacturer he must employ a modeller to produce an original design. This accounted for the extensive employment of modellers in France. The reverse of that practice existed in this country, for a manufacturer never thought of employing a modeller if he met with a design already suited to his purpose. Hence there was comparatively little employment for artistic workmen in England. He gathered, from the tone of the meeting that they were unanimous on the subject of the desirability of securing the Soulages Collection to the country, and indeed, amongst intelligent men, he thought there could be no difference of opinion upon that subject. Drawings were very good as far as they went, but those who had any experience in manufactures were aware of the inferiority of drawings in comparison with models. In order to make schools of design effective, they must also have museums of art manufactures.

A vote of thanks was passed to Mr. Crace.

Mr. Crace's paper was illustrated by numerous specimens from the Soulages Collection, kindly lent by the Committee of the Manchester Art Treasures Exhibition, as well as by a series of photographs, representing all the principal specimens. These will remain at the rooms of the Society until Tuesday next, for the inspection of members and their friends.

The Secretary announced that on Wednesday evening next, the 3rd February, a paper by Mr. Robert Rawlinson, "On House Accommodation—its Social Bearing, Individually and Nationally," would be read. On this evening the Earl of Shaftesbury will preside.

The following letter has been received by the Secretary since the meeting:—

DEAR SIR,—Several points arose during the discussion last evening, on some of which I wish to offer one or two observations.

The most suggestive and popular exhibition ever held within our walls, was probably that to which Mr. Farrer alluded in the course of his speech, and to which he himself so largely contributed, and in the careful management of which he took so important a part. That collection of objects of mediæval art was the origin of much of the taste for this class of historic art which has since so largely and usefully prevailed. To it we probably owe the interest which the Soulages Collection has so extensively excited, and the anxiety so universally expressed that one so unique and valuable should become public property. Under these circumstances it is certainly much to be regretted that our government should hesitate to purchase it, but I am not one of those who attribute that hesitation to either ignorance or indifference. It is the result of those discussions which always take place in the House of Commons when any vote is proposed for material educational apparatus. The fault is with us—the people. We send representatives to parliament who cannot understand or appreciate objects of art, and who think they are obeying the behests of their constituents when they object to furnish funds for the purchase of collections like this. The remarks made by some of our skilled workmen during the discussion afford additional evidence that they really understand the matter much better than many of those who affect to represent them.

Looking at the question simply as one of Political Economy, on which statesmen ought to be well read, national collections of art should be promoted. Anything which tends to improve the public taste, profitably occupies the time and faculties of producers, by the ordinary process of demand and supply. But, besides this consideration, which was so fully and ably descanted upon by some of the persons who took part in the discussion, we ought to know that anything which attracts foreign visitors to our cities, is so much gain to the national revenue. I am of opinion that the works of art, the museums, and the splendid buildings which so largely abound in Paris, Rome, Florence, Munich, Dresden, and elsewhere on the continent, are ultimately paid for by the innumerable foreigners who are tempted by them to spend time and money in their contemplation.

I cannot but hope and believe the ventilation of this question last night by Mr. Crace and the competent authorities in the room who supported his views, will lead to the preservation intact, and for national purposes, of the Soulages Collection.

I am, &c.,
THOS. WINKWORTH.

January 28, 1858.

SEWAGE OF LONDON.*

By Henry Allnutt.

Amount of Sewage per Head of Population.

In the report of the Metropolitan Drainage, page 15, we find it stated there are 15,249,777 cubic feet, or 95,311,106 gallons of sewage passing off daily from 75,251 acres, or 117½ square miles, the area of London, and that the population being taken at 2,656,000, it gives 5·8 cubic feet of sewage per head.

Now, 5·8 cubic feet is 36 gallons, and treating this as the amount of sewage for each individual in the population is really monstrous; if we approach the London sewage question in this way, and adopt these figures, it cannot surprise anyone that we are confounded, and utterly at fault to control and apply such a body of liquid to agricultural purposes. The mere drainage alone of 75,000 acres of land, or, as the referees recommended, 226,000 acres of land, in the matter of rainfall and spring water, without a particle of sewage, would be no light undertaking, but when we add the sewage to the water, and then propose to pump up that sewage and water from a considerable portion of this area daily (nearly 24,000 acres), and convey this with the water and sewage that flow down by gravitation from the remainder of the area (24 miles) to the sea reach, we have a task, indeed, before us, enough to tax human powers a thousand times more seriously than the launching of the *Leviathan*. But, I ask, wherefore the necessity of such an undertaking—why touch this mass of water? I contend that there are two distinct objects to deal with in what is called the London Drainage, which as long as they are blended together will defy the ablest intellect, but when separated will be, individually, easily manageable.

The first object is to drain the present area of 60 square miles, or, adopting Mr. Bazalgette's figures, 117 square miles, of the rainfall and spring water, into the Thames, and we may add to this the water that is thrown into the kitchen sinks of dwelling houses; for this latter is, at most, but dirty water, and would never prove offensive if allowed to run into the Thames with rain or surface water. No one can argue that this water from the kitchen sinks is of any agricultural value, or worth the expense of collecting. The most direct course should be adopted for the removal of all this rain, and, what I may term, harmless water, to the river. The present sewers, as far as they go, answer this purpose, no doubt, in the lowest situations. The mouths of the sewers should either be rebuilt with large sectional areas for a greater discharge of water during low tide (see the extract from Mr. Giult's Report, page 315, in the Referees' Report), or an intercepting sewer could be formed to catch the water from the higher ground, and thus make the discharge continuous at all tides.

The second object is to remove the really offensive portion, and I believe that instead of 36 gallons per head, two gallons would be an ample allowance for each individual, and this should not be permitted to run into the Thames. To show how reasonable I am in saying two gallons, I find in the said Report (pages 51 and 52) that each adult voids, on an average, 46 oz. per diem (40 oz. urine, and 6 oz. fæces). Let this be considered 3lbs. As two gallons of water weighs 20 lbs., we shall still dilute the excrement with nearly six times its weight of water, viz., 17 lbs. In properly constructed water-closets, it is found that only 6 pints of water is employed each full lift, and therefore I submit that 16 pints is a sufficient allowance to each head of population, and will even allow for water from certain manufactories, &c., when we remember we are calculating as though the 2½ million of inhabitants were all adults, which of course is not the fact. Now if the present sewage, with nearly half of the cesspools not yet abolished, is worth 2d. a ton, and we reduce it to one-eighteenth of its present bulk, the value of the sewage will be more than 3s. per ton. Any fertilising properties that may escape in the washings of the streets will be far more than compensated by the additional water-closets which have still to be provided for 140,000 houses.

I may here observe that some parties place an agricultural value on the water that is poured down the sinks of dwelling-houses, and also from the washings of the streets, as above alluded to.—First, as to water running down the sinks; it really is nothing but dirty water, from the scouring of pots and rooms—slops from the bedrooms are thrown down the water-closets, not into the sinks; however, a short code of regulations could easily be drawn up and circulated amongst the inhabitants. It would be directly to their interest to pay attention to these orders for the sake of the income derived from the sale of the sewage, and consequently the lightening of the parish rates. Secondly, as respects the water from the streets. If scavengers do their duty, and remove the mud and dirt daily, there really cannot be anything left in the mere washing of the streets, worth collecting and removing to any distance for agricultural purposes. We must be content to stop somewhere. It might also with some reason be said that pure clean water is useful for irrigation, which is true, but it would not pay to collect it day by day all the year round, and convey it to farms some miles distant. The question is, which course is the best to adopt; to run all the sewage of London entirely to waste into the sea, or to separate and retain the most valuable portion and allow the waste to flow into the river. If we attempt to utilize the most valuable part of the sewage, it is within our power, but when we endeavour to make use of the present bulk of sewage, we are overpowered; our motto should not be all or none—there must be some waste in every operation, and after all, the water, if separated from the real sewage, will perform the duty of scouring the river.

The person holding the office of Inspector of Nuisances could regulate the manufactories, stables, cow-houses, and slaughter-houses, and see that proper steps were taken to make the communication either to the rain-water sewers or to the real sewer pipes. As a case in point, I maintain that the water which runs from the breweries should flow at once into the river, as also the condensed steam from steam-engines. On the other hand, urinals, stables, &c., should discharge into the sewage proper pipes.

In page 20 of the Report, the referees state that "they have carefully observed the condition of the London streets, and that the water which flows from them, especially in rainy weather, contains foul organic matter to a serious extent." A more particular attention on the scavengers' part would, in a great degree, remedy this evil, and rainfalls are only occasional. With respect to their other remarks upon the rain-water pipes being used as soil pipes, and gutters in many of the inferior streets receiving every night large quantities of urine and other offensive matter, these evils might be, to a great extent, removed by the erection of proper water-closets.

Disposal of the Real Sewage.

We now arrive at that part of the subject which refers to the treatment of the sewage, supposing the plan is adopted for bringing it into a much smaller bulk. I am still of opinion that London should be divided into districts, and that the sewage proper should be run into a

* Continued from page 105.

reservoir, or, say two receptacles, in case an unforeseen difficulty arises to prevent its being removed immediately. It now becomes a question as to whether it should be deodorised or removed from the reservoirs to the land as quickly as possible. I do not attempt to decide this question, but I may say that if the former course is followed it will necessitate a great outlay for the chemical or charcoal without a correspondingly increased value to the sewage. I think my plan of removing the sewage in closed railway trucks (wrought iron) might be carried out. We have information in the Report, that the sewage is conveyed from some towns in pipes, but as repects the London sewage, I think the distance into the country would be too great, and it appears to be a fact that pipes are liable to be clogged or filled up (see Report, page 475); therefore I consider that the better plan would be to convey the sewage in closed railways trucks on a line of railway to the neighbourhood of the farms requiring it. A consideration now arises as to which will prove the most economical method of filling the trucks, whether by forming an incline way down, to below the reservoirs, and so permitting the sewage to flow by its own gravity into the trucks, or by pumping up the sewage from the reservoir into the trucks. I conceive there are many objections to pumping; first, the ordinary kind of pumps is not adapted to raise sewage (see Report, page 38-389), and if screw pumps or scoop wheels are employed, it may require two or three lifts; secondly, the denser parts will always be settling at the bottom of the reservoir, and to prevent this the sewage must be agitated during pumping by forcing in air at the bottom of the reservoir, or by other means. This will have a tendency to increase the nuisance; the more it is disturbed, the greater will be the emanations from the sewage. On the other hand, if trucks are filled direct from the reservoir, the latter could be formed like an inverted cone, and the sediment would be the first matter to flow into the trucks. I would counter-balance the weight of the truck by having an empty one descending as the loaded truck was being drawn up the incline, so that the power would only be exerted to draw up the sewage. The trucks, if constructed of wrought sheet iron, (perhaps old boiler plates might be used) somewhat in the shape of an inverted cone, discharging from the bottom, could be made to hold about 6 or 8 tons, being 1344 or 1792 gallons. A truck 12 feet long, 6½ feet wide, and 4 feet deep inside in the clear, would hold nearly 8¾ tons or 1950 gallons. Now, if there are at present 95,311,106 gallons of sewage daily, and we reduce it to $\frac{1}{18}$=5,295,061, and divide this amongst 10 districts, it would give 529,506 gallons to be removed from each district daily, and, lastly, if a truck would contain 1,900 gallons, it would be about 280 truck loads a day, or under 12 loads an hour. If we have 20 districts instead of 10, the result would be only 6 truck loads of sewage an hour to remove, which could be deodorised or not, according to circumstances. With respect to the cost of conveying the sewage into the country, I think when a large quantity would have to be regularly removed, it might be done at ¼d. per ton per mile. Supposing we wished to convey it to Ascot Heath from Walham-green, near the West London Railway, the distance round by Hounslow would be about 26 miles. The cost of one truck containing 8 tons of sewage would be as follows:—Sewage at 3s. per ton, £1 4s., carriage 4s. 4d., total, £1 8s. 4d., or 3s. 6½d. per ton. I cannot enter into any estimate of the expense of working the plan, of the wear and tear, or of the cost of the railway rolling stock, but I think it is quite evident that the value of the sewage would be such as to be well worth the expense of these works for its removal and application to the land.

The cost of removing the sewage and rain-water to the sea is estimated at upwards of £5,000,000, but this amount might be found insufficient, and, indeed, may be doubled, taking into consideration the magnitude of the proposed works, and their peculiar nature; whereas, the mere laying down another set of sewers to the water-closets, is no uncommon work, and I beg to throw out the suggestion that there is no real necessity for having the sewers for the water-closets so deep or so low as the generality of the present sewers. The water-closets are not often situated in the basement—there is no necessity that the water-closets should be placed so low in a house. Mr. Bazalgette is stated, in page 21 of the report, to have estimated the cost of draining London in this manner at £10,000,000; £5 a house, for 300,000 houses, would give £1,500,000, but if it amounted to double this sum, you would have a set-off in the value of the sewage, which is stated in the report (page 752) to be £1,444,000 per annum, but nothing whatever of a reproductive nature will arise from the expenditure of £5,000,000 to cast the sewage into the sea; indeed, the estimate is still greater than this when we include the covering of the main channels, which expense is not estimated or provided for in the Referees' Report.

I have only one other observation to offer, and that is, has it thoroughly been investigated, what effect is likely to take place from the abstracting 15,000,000 of cubic feet of sewage daily (the present amount) from the Thames; would not the river, in consequence, be much lower at low water and the bed more exposed, especially when we take into consideration that by the plan of the referees it is contemplated, when the sewage flowing in the main channels in dry weather becomes too low, to let a considerable body of the Thames water into the main channels, to keep up the uniform depth of 16 feet. I, therefore, repeat, when not only the 15,000,000 of sewage, but also a great body of water (the amount of which is, I believe, not even estimated in the report) will be actually abstracted from the Thames (in the dryest season of the year) to assist the flow of the sewage in the channels, there is great reason to fear that the effect on the river will be very serious, in fact, the volume of water will be most materially lessened; we may say that the supply of fresh water will be almost cut off or turned aside from the river in dry summer weather.

From all these remarks it will be seen that we may well hesitate in adopting the scheme for removing the sewage, &c., to the sea, by works of such magnitude, which are even already admitted, in the very outset, to be insufficient in heavy rainfalls; and let us hope that means will be found to remove the really offensive part of the sewage, and deal with that alone, not with a view of casting it into the sea, but of applying it as manure for the land. The supply of guano is not, and, indeed, cannot be unlimited, and a man would be truly considered an enemy to mankind who wasted the gifts Providence had placed within his reach. No one but a madman would cast away his capital, and what else is manure to an agriculturist, the most valuable he possesses, without which he cannot flourish—he may plough and he may sow, with the greatest care and diligence, but without food for the plant how can he expect to reap a rich harvest, nay, he may reap, but what has he worth cutting, if the land has not received its proper dressing of manure; and as steam cultivation is beginning to make itself apparent, manure will be in still greater demand; this, I think, cannot be denied. True, it may be urged that though London may throw all its valuable manure into the sea, this would be no reason why all the other towns in England should waste theirs also. Perhaps not, but the metropolis will be setting a very sad example, and future generations will point at the folly of the present generation, and wonder how men could be capable of throwing away so great a treasure, whilst the smaller towns turned their sewage to a useful account. It may be quite true that in Leicester, or some other towns in England, they may not have arrived at the best plan of utilising the sewage, but, depend upon it, if one way will not answer, another will be discovered. In the present scheme for the drainage of London, we not only do as much

mischief as we are able with the sewage of the present day, but we go ahead, and in our plans provide for casting into the sea, and thus wasting the sewage, when London is double, nay, four or six times the size it now is. It is somewhat like a man who is not content with injuring his estate during his own life, but he needs must leave behind him a perpetual charge to drain the estate, ever after, of a great portion of the profit-rent. The sewage of London should be separated from the rainfall and mere dirty water; the former should be looked on as a mine of wealth, and cared for accordingly, whilst the latter should be carried off to the river by the present sewers. Let us express a fervent hope that common sense will prevail.

SOUTH KENSINGTON MUSEUM.

During the week ending 23rd January, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,788; on Monday, and Tuesday, (free evenings), 3,821. On the three students' days (admission to the public 6d.), 775. One students' evening, Wednesday, 57. Total, 8,441.

Home Correspondence.

LORD PALMERSTON'S MORTAR.

SIR,—In the *Journal* of the 8th January, Mr. H. W. Reveley, in noting the partial failure of the monster mortar known as "Lord Palmerston's," lays before your readers a plan of his own for constructing what he considers "indestructible ordnance," his plan being as follows:—"To construct all large ordnance with a soft steel spiral bore of sufficient strength to resist the explosion, upon which should be cast a metal jacket of brass or iron."

In the first place, the welding of such a mass of steel is open to serious objection. Steel being a metal so easily destroyed by heat, even admitting that the welding could be satistactorily performed, the cast "jacket" would most assuredly destroy it; indeed, I attribute the failure of Krup's steel gun to the cast iron "jacket." By running a fluid metal around the bore, the outer surface would be brought into, and kept in, a welding state, and the cohesive power of the metal materially weakened if not altogether destroyed.

Hammered cast-steel has a cohesive strength about seven times greater than cast iron, but the strength of crystallized steel is not equal to that of cast iron.

I speak of crystallized steel, because I am of opinion that running a "jacket" of cast iron or brass around the steel bore would bring it up to, and for some time keep it at, a welding heat. This would induce crystallisation, and, I fear, on trial Mr. Reveley would not find his ordnance really "indestructible." Then, again, the shrinkage of steel being greater than that of cast iron, a space would be left between the "jacket" and bore. I consider the plan defective even for light ordnance, having, at the end of 1855, constructed a small cannon of malleable iron and steel, the bore being made of the strongest mild cast steel, cast hollow, and hammered on a mandril (it was cast hollow to save welding) to bring the particles into the closest possible contact. It was then heated to a low white heat, placed in the moulding box, and liquid malleable iron poured round it. After finishing, it was submitted to the following tests; first charge, 7 oz. of powder, a conical malleable iron ball weighing 9 ozs., and a wad; second charge, 8 oz. of powder, two conical balls, 17 oz., and wad; afterwards with 8 oz. of powder, three conical balls, 1¾ lb., a wad, and filled up to the muzzle with wet cotton waste, which was driven home with a sledge hammer. This latter charge was repeated several times, when it was found that the steel had split longitudinally from the muzzle for about three inches. I have no hesitation in saying the cannon would have gone to pieces had not the iron been so strong. A gun barrel made from the same iron in the usual way, in Birmingham, stood respectively 7, 14, 21, and 28 drachms of powder and a conical ball, and burst with 35 drachms and a conical ball. 7 drachms is a proof charge, and 2½ a service charge.

I am, &c., W. HAWKSWORTH.

Avon Steel and Iron Works, near Linlithgow,
January 14th, 1858.

REGISTER OF RAINFALL.

SIR,—I am disposed to agree with Mr. J. Bennett Lawes as to the greater accuracy of the larger rain guage. Of the three which I assisted in registering hourly for upwards of five years, in one of our colonies, I preferred one of the following form:—A funnel-shaped receiver, three feet square (9 square feet), surmounts a box of metal, accurately made, down the side of which is fixed a barometer-tube, bent at the bottom, and inserted into the box. The area of the receiver and the contents of the box were calculated, and verified by actual measurement with water.

On falling into the receiver and passing into the box, the water rises in the barometer tube. Water is kept in the box up to a low point in the tube, marked zero, and the length of the tube is painted in terms of the inch on the outside of the metal box. By this means, depending on the relative proportions of the box and receiver, the smallest quantity can be seen at a glance. The neck of the funnel-shaped receiver is to be made small, to prevent evaporation. A small cock at the bottom of the metal box furnishes the means of emptying it. The height of the surface of the guage above the ground, and the nature of the stand or support, will depend on circumstances, but, of course, the former is an important scientific element in the results.

I am, &c., T. E. W.

AGRICULTURAL IMPLEMENTS.

SIR,—On reading a letter to you, published in the *Journal of the Society of Arts*, Dec. 25th, 1857, headed "Agricultural Implements," by Mr. William Waller, of Uddingston, I would merely beg to remark that I was witness to an acre of beans being cut in an hour, by a machine impelled by a pair of horses and guided by one man, in the Carse of Stirling, as far back as the year 1812.

It was the invention of the late James Smith, of Deanston, a name well-known to most agriculturists and machinists.

A model of this machine may be seen in the Hunterian Museum of the University here.

I am, &c., JAMES BUCHANAN.

40, St. Enoch's Wynd, Glasgow, Jan. 11th.

P.S.—I fancy some are still to be found in the Carse of Stirling of this kind, as subsequently improved by Mr. Smith, ere he left Deanston.

Proceedings of Institutions.

BIRMINGHAM.—Mr. Toulmin Smith recently delivered an interesting lecture on "The Fairy Mythology of England," in the theatre of the Midland Institute. The lecturer, who was introduced by Mr. A. Ryland, commenced by observing that mythology, which was the most early association connected with man's history, was full of belief. He should confine himself on that occasion to the popular fairy mythology, as derived from our Scandinavian forefathers, which was more poetic in its parts and nobler in its spirit than the mythologies of Greece and Rome. It was not handed down to us in our own Anglo-Saxon tongue, owing to the early introduction of Christianity; but it was perpetuated in the old written tongue of the North. The lecturer then quoted

a translation from the original language of a poetical account of the creation of the "alfs," or elves, as they are now more familiarly designated. Glancing at the legend of Thor having obtained his renowned hammer from the alfs, the lecturer next referred to the great swordsmith, Wieland, who was supposed to have resided in the White Horse Valley, Berkshire, and whose fame had been immortalised by Sir Walter Scott, in his romance of "Kenilworth," and was casually alluded to in a note to "The Lady of the Lake." Mr. Smith illustrated this portion of his subject with translations from the Runic legends. He next dwelt upon the achievements of Beowulf, the parent of knight errantry, and then proceeded to speak of King Arthur. The fullest details respecting the elf-wrought armour of Arthur, were to be found in an old Saxon ballad, descriptive of the monarch arming for battle. This he recited. He then referred to Merlin, who was said to have conveyed Stonehenge over from Ireland to Salisbury Plain in a single night; and who worked in a cavern underneath it, but having fallen in love with the "Lady of the Lake," she placed an enchanted stone over the entrance, and thus gave rise to the tradition that he and his assistants could be heard working at night with their hammers and anvils. Having quoted from the writings of Drayton, who lived two centuries ago, and a ballad composed on the occasion of the visit of Queen Elizabeth to Kenilworth, in 1575, in exposition of this legend, he described Arthur's fairy death in the Lake of Avelon. He, however, ignored the assertion that the history of Arthur was fabulous, and maintained that faith should be placed in the existence of "the Celtic hero." Having observed that time would not admit of his introducing, as he intended, the stories of Guy of Warwick and the destruction of the great boar, and St. George and the Dragon, Mr. Smith pointed out that in the whole range of Old English poetry there was no description of Elfland, but merely vague and shadowy references to it, in support of which argument he quoted selections from Spencer and Chaucer. He remarked that the Scotch bards in this respect differed from those of England, adducing in corroboration a passage from the romances of Thomas the Rhymer. In conclusion he laid down the principle that the northern mythology must not be regarded as having any association with witches and witchcraft, the former being founded on belief, and the latter on superstition; and he closed his lecture by contrasting two old poems, descriptive of the wild orgies of the witches, and the gambols of the white elfs by moonlight. The lecture was listened to with much attention.

CROYDON.—The annual meeting of the Literary and Scientific Institution, was held on Wednesday, December 2nd, 1857, Thomas Farley, Esq., President, in the chair. The honorary secretary read the last report, which shows that progress has been made during the past year. The number of members during the first quarter was 301, during the second quarter 478, during the third quarter 633, and during the fourth quarter 333. The total income of the Society for the year was £336 13s. 11d., and the expenditure was £266 3s. 8d., showing a balance in favour of the Institution of £70 10s. 3d. From this, however, has to be deducted a sum due to the treasurer, so that the actual balance in favour of the Institution is £46 1s. 11d. The lectures which have been delivered during the past year have been of a varied and attractive character, and the attendance has been highly satisfactory. Since the 1st of October, 1856, the following have been given at the expense of the Institution:—E. P. Hood, on "The Wonderful Transmigration of Words;" Ellis Roberts, "Entertainment on the Harp;" H. Phillips, "Origin and Decline of Sacred Music in England;" H. Blackburn (two), "Algeria—Its Manners, Customs, and Scenery;" Dr. Steggall, "The Chamber Music of England;" H. Hunt, "Application of Physical Sciences to the Useful Purposes of Life;" G. Grossmith, "David Copperfield;" Dr. Leask, "Life and Times of Mahomet;" G. Grossmith, "Lectures on Lecturing;" H. Phillips, "The Songs of Dibdin;" Angus Fairbairn, "A Scottish Musical Entertainment;" Dr. Spicer, "Æsthetics;" G. Grossmith, "Nicholas Nickleby;" Mrs. Balfour, "Celebrated Women;" Dr. Spicer, "Architecture." Mr. H. Phillips gave his entertainment on March 26, free of charge to the funds of the Institution; as did also Dr. Spicer his lecture on "Architecture," on May 21st. Lectures have also been delivered gratuitously by the following gentlemen:—Rev. J. G. Hodgson, on "A few Common Things;" J. W. Flower, Esq., (Park Hill), "The Study of Natural History;" Col. Rowlandson, (Addiscombe) "The Chain of Brahminical Caste;" Rev. W. H. Johnstone (Chaplain at Addiscombe), "Nineveh;" Rev. W. Mitchell, "The Habits and Instincts of the Hive Bee." These lectures are thought to have done more real service to the Institution than any received from paid lecturers; the list of gratuitous lecturers will be still more extended during the ensuing year. That delivered by J. W. Flower, Esq., has been published at the request of the members, and has been a source of profit to the funds of the Institution. Nearly 300 volumes in the library have been re-bound, partly through the liberality of Mr. Westall, who gave 10 guineas for this purpose. The exchange of books has frequently averaged from 100 to 150 volumes every issue night. During the first quarter of the year, 1878 books were circulated among the members, and during the next quarter the circulation was very much larger. A printed catalogue is in course of perparation. Several donations of books have been made during the past year; 196 vols. have been also added by purchase, many of these being the works of recent and standard authors. The committee regret to report that the reading room has not been as yet made more available, and has not been more used of an evening by the majority of the members for whom it was more especially designed. The committee have not been able to establish evening classes for reading, writing, and arithmetic, as proposed. The difficulty of providing proper superintendence has at present prevented this project from being actually carried out. It is, however, earnestly hoped that evening classes for adults may be among the earliest works of the new committee in the ensuing year.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 2. General Monthly Meeting.
Architects, 8. Mr. Edward M. Barry, "An Account of the New Palace at Westminster, and the progress of building the same."

TUES. Royal Inst., 3. Prof. Huxley, "On Animal Life."
Civil Engineers, 8. Mr. J. Henderson, Assoc. Inst., C.E., "On the Methods generally employed in Cornwall, in Dressing Tin and Copper Ores."
Pathological, 8.
Photographic, 8. Anniversary.

WED. Society of Arts, 8. Mr. Robert Rawlinson, "On House Accommodation,—its Social Bearing, Individually and Nationally."
Geological, 8. Sir R. Murchison, "On the Succession of the Lower Palæozoic Rocks in the North-west Highlands of Scotland."
Pharmaceutical, 8.
Royal Soc. Lit., 8½.

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Zoological, 3.
Royal Society Club, 6.
Antiquaries, 8.
Chemical, 8. I. Dr. Bird Herapath, "On the Iodo-sulphates of Cinchonine." II. Mr Mercer, "On Atomic Weights."
Linnæan, 8. I. M. Fée, "On the Nomenclature of the genus *Buffonia*." II. Dr. F. Muler, "On the *Eucalypti* of Northern Australia."
Philological, 8.
Royal, 8½.

FRI. Archæological Inst., 4.
Royal Inst., 8½. Dr. E. Lankester, "On the Drinking Waters of the Metropolis."

SAT. Asiatic, 2.

SAT. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Jan.* 22, 1858.]

Dated 19th December, 1857.

3117. Thomas Hart, junr., and Abel Jones, Blackburn—Improvements in looms called "dobby looms."

Dated 24th December, 1857.

3160. George William Hart, 5, Osborne-terrace, Southsea—Improvements in the construction of locks, and in apparatus for cutting keys.

Dated 30th December, 1857.

3184. John Blake and Richard Dugdale Kay, Accrington—An improved apparatus for reducing and regulating the quantity, force, or pressure of steam.

3192. John Clinton, 35, Percy-street, Middlesex—Improvements in the manufacture of wind musical instruments played by the mouth, and in mandrils used in such manufacture.

Dated 4th January, 1858.

10. Thomas Scott, Drummond-street, Euston-square—Improvements in cleaning, separating, and mixing seeds, and in apparatus for those purposes.

11. Edmond Thomas Tillam, St. Mary's Hospital, Paddington—Improvements in apparatus for ventilating buildings.

12. Frederick Walton, Haughton Dale Mills, Manchester—Improvements in the manufacture of sheets or plates made of plastic compositions and other materials, and in the application thereof, either alone or in combination with other substances, to the manufacture of knife handles, mouldings, artificial veneers, floor-cloths, and other ornamental and useful purposes.

13. Edward Hamlin Kiddle, Broad-street, Lambeth—Improvements in smut machines.

Dated 5th January, 1858.

14. James Ellis and Joseph Henry Ellis, Leicester—Improvements in machinery for subdividing, or reducing into small particles, masses of rock and minerals.

15. John North Wilkins Twigg, Coventry, and William Adkins, Birmingham—Certain improvements in self-acting railway brakes.

16. James Leeming and John Carter Ramsden, Bradford—Improvements in looms for weaving.

18. George Edward Dering, Lockleys, Hertford—Improvements in electric telegraphs, and in the manufacture of insulated wire and cables.

Dated 6th January, 1858.

19. Thomas Fildes Cocker, Sheffield—Improvements in the manufacture of wire applicable to umbrellas and parasols, and to articles of dress.

20. Richard Archibald Brooman, 166, Fleet-street—An improved lock buckle. (A communication.)

21. Henry Constantine Jennings, 8, Great Tower-street—Improvements in the production and application of tannin or tannic acid.

22. James Drysdale Malcolm, 47, Leicester-square—Improvements in apparatus for ornamenting fabrics and other surfaces.

Dated 7th January, 1858.

23. Manuel Leopold Jonas Lavater, 23, Holywell-lane, Shoreditch—The application of the principle of exhausting air as used in plate holders, breast pumps for pegs.

25. Christophe Adrien Thiry, Paris—A new or improved oyster holder.

27. James Reilly, junr., Manchester—Improvements in chairs and seats of various descriptions.

29. Richard and John Philp, Norwood-house, Cheltenham—An improvement in propellors for propelling ships, boats, and other vessels in water.

30. Edwin Maw, Doncaster Iron Works, Cheshire—Improvements in the construction of metallic bedsteads and other surfaces to sit or recline on.

31. George Jean De Winton de Winton, Junior United Service Club, Charles-street, Saint James', Westminster—Improvements in copying apparatus. (A communication.)

Dated 8th January, 1858.

32. Samuel Lees, Salford—Improvements in the manufacture of mineral oil.

33. Henry Raymond, Bristol—Improvements in propelling ships or vessels.

34. Peter Soames and John Campbell Evans, Morden Iron Works, East Greenwich—Improvements in steam cranes, parts of which improvements are applicable to the generation of steam.

35. Richard Archibald Brooman, 166, Fleet-street—A method of and apparatus for teaching music and arithmetic. (A communication.)

36. Henry Atkins, Nottingham—Producing scarfs, neck-ties, and other articles from the warp machine.

37. Thomas Greenwood and John Batley, Leeds—Improvements in machinery for heckling flax and other fibrous materials.

Dated 9th January, 1858.

38. Robert Brown, Liverpool—Improvements in water-closets, parts of which are applicable to pumps.

39. William Church, Birmingham—Improvements in measuring rules, compasses, and in the machinery to be employed in manufacturing measuring rules and other mathematical instruments.

40. Thomas Rowell, Sunderland—Improvements in furnaces.

41. William Parsons and James Attree, Brighton—An improvement in the measuring of water and other liquids, and an improved water and liquid meter.

42. Jules Alphonse Mathieu Chaufour, Paris—Certain improvements in the construction of axle-boxes and axle bearings.

Dated 11th January, 1858.

44. Thomas Knowles, Hollingrove, Bury, and William Ogilvie, Manchester—Improvements in looms.

46. William Hartree, Lewisham-road—Improvements in furnaces or fire-places.

Dated 12th January, 1858.

48. André François Emile Robert, Paris—Improvements in the manufacture of curtains and hangings for walls and other places.

Dated 13th January, 1858.

50. George C. Greenwell, Radstock, near Bath—An improved pigment.

52. George Walker Muir, Manchester—Improvements in warming and ventilating.

54. Edward Brailsford Bright, Liverpool—Improvements in communicating signals by electricity, and in the apparatuses employed therein.

56. William Parsons, Pratt-street, Old Lambeth—Improvements in apparatus for supplying water to, and for preventing explosions of steam boilers.

58. Jean Baptiste Amédée Couder, Paris—Improvements in shawls.

Invention with Complete Specification Filed.

70. Marc Antoine François Mennons, 4, South-street, Finsbury—Certain improvements in gas retorts. (A communication.) 16th January, 1858.

WEEKLY LIST OF PATENTS SEALED.

January 22nd.

1744. Christopher Dicran Seropyan.
2022. William Deakin and William Phillips.
2024. Charles Fréderic Vasserot.
2026. Edward Wilson.
2028. Joseph Needham.
2033. John Scott Collins.
2040. Rd. Archibald Brooman.
2050. Wm. Stettinius Clark.
2094. Guillaume Félix Aroux.
2154. Wm. Alexander Clarke.
2164. John Parkinson.
2394. Thomas Robson.
2432. Henry Bessemer.
2576. William Mac Naught and William Mac Naught.
2652. Lucien Arbel.
2808. Henry Bessemer.
2832. Alexander Parkes.
2840. Alexander Parkes.
2890. Emile Alcan.
2898. Charles Wye Williams.
2930. Walter McFarlane.

January 26th.

2038. William Blake Richardson.
2045. Benjamin Richardson.
2051. Edwin Hallen.
2058. Edward William Baxter.
2060. Pierre Alexis Francisse Boboeuf.
2063. John Bethell.
2069. William George Plunkett.
2076. Thomas Ivory.
2079. James Alfred Limbert.
2091. William Jewett Harris.
2096. Edwin Maw.
2113. William Colborne Cambridge.
2116. Sebastien Botturi.
2117. Sebastien Botturi.
2121. Sebastien Botturi.
2178. Hubert Pirotte.
2224. John Dauglish.
2260. Alfred Vincent Newton.
2269. Alfred Vincent Newton.
2843. Henry Critchett Bartlett.
2882. George Tomlinson Bousfield.
2901. Henry Davis Pochin and James Woolley.
3023. Frederick Oldfield Ward.

Patents on which the Stamp Duty of £50 has been Paid.

January 18th.

170. William Kilgour.

January 19th.

187. Barnett Samuel.

January 21st.

182. John Livesey.

January 22nd.

181. Charles William Tupper.
196. John Lamacraft.
227. David Moline.

January 23rd.

173. Frederic Prince.
200. Joseph Leese.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4044	Jan. 16.	Improved Link or Fastener for Shirts, Gloves, and other articles of Wearing Apparel	Edwin Page	Birmingham.
4045	„ 21.	The Princess Royal Envelope for Needles	W. Bartleet and Sons	Redditch.
4046	„ 22.	A Rule, Pencil, and Pen-holder Combined	George Frederick Morrell	149, Fleet-street.
4047	„ 23.	A Casement Stay	Wm. Tonks and Son	Birmingham.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 5, 1858.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of *recent* Inventions.

Persons intending to contribute to the Exhibition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.
2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relating to this subject, has been prepared at the request of the Committee, by D. Roberton Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. Macgregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

T. D. Acland	£ 5	5
J. G. Appold	10	10
Harry Chester	10	10
C. Wentworth Dilke	10	10
Lord Ebury	5	0
J. G. Frith	5	5
F. Seymour Haden (annual)	2	2
Edward Highton (annual)	2	2
The Marquis of Lansdowne	20	0
Sir Thos. Phillips	5	5
Arthur Trevelyan	1	0
T. Twining, jun	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S.	10	10

FIBRES FROM CEYLON.

Samples of Fibre from Ceylon have been received by the Society, through Messrs. Frith, Sands, and Co., and the following is the broker's report thereon :—

Nos. 1 and 2. Pine-apple Fibre, good colour and fine fibre, rather short; if available for spinning on flax machinery, which it apparently is, it would be worth £56 or £60 per ton.

No. 3. A longer, softer fibre, but not of such good colour. Value about £55 per ton.

No. 4. Plantain Fibre, of fair colour and length, suitable for mixing with Manilla Hemp. Value, £28 or £30 per ton.

No. 5. Coir Fibre, clean, even, of good colour, and strong; if a parcel were landed as good as this sample it would realize £35 per ton.

The samples may be seen at the Society's house.

THE *BOMBYX CYNTHIA.*

The following communication has been received from the Colonial Office:—

Downing-street, 29th January, 1858.

Sir,—I am directed by Mr. Secretary Labouchere to request that you will lay before the Council of the Society of Arts a copy of a despatch from the Governor of Malta on the subject of the *Bombyx Cynthia* silkworm.

I am, Sir, your obedient servant,
HERMAN MERIVALE.

The Secretary to the Society of Arts.

(Despatch referred to.)

Palace, Valetta, December 22, 1857.

Sir,—In 1854, I made several reports on the *Bombyx Cynthia* silkworm, which feeds on the castor-oil plant, for the information of the Society of Arts. It had been introduced into Malta from India in that year, and appeared both hardy and wonderfully prolific, yet it failed in Malta in 1855.

2. I had, however, previously distributed a great number of eggs, by sending them to Italy, France, and Algeria; and I continued to watch the accounts of the trials made in those countries. I found that it had spread there, and had been carried to Spain and Portugal, and was creating considerable interest wherever it had been tried.

3. I was therefore induced to re-introduce it into Malta. At the end of July last, I received a few eggs by post in a quill from Paris, and these have multiplied in an extraordinary manner, so that I have not attempted to have them counted. The temperature of the winter season, now in December, seems, however, to be affecting them even in Malta, inasmuch as they grow more slowly than they do in summer, but, nevertheless they appear healthy.

4. A very interesting paper on the progress making in different countries in rearing the *Bombyx Cynthia* will be found in the last number of the papers of the French Société d'Acclimation. This paper is by the able President of that Society, M. Geoffroy Saint Hilaire.

5. I had, in 1854, successfully sent the insect to the West Indies. The French Society have sent it to Brazil, to the Southern United States, and into Egypt. It is being introduced into Germany, and we are now sending more eggs and worms from Malta to Sicily.

6. Experiments are making in France on spinning the silk, which is found to be very fine, very strong, and to take dyes well. In France, the cocoons are carded and afterwards spun, as in Malta. It is said that the chrysalis, on extricating itself from the cocoon and becoming a moth, does not, as was supposed, cut the thread; and the French have partially succeeded in unwinding the cocoons.

7. The great interest I find taken in other countries in the attempts making to naturalise the *Bombyx Cynthia*, has induced me to report to you its re-introduction into Malta, with the view of begging you to make this known to the Society of Arts. I enclose an extract from my despatch, dated 7th July, 1855, which explains the manner in which I successfully sent the insect to the West Indies, and in the same manner it may be easily conveyed from any one country to another. It may be found difficult to preserve this silkworm throughout the winter season, as well as difficult to grow the *Ricinus*, its proper food, in the climate of Europe. The proper climate for the *Bombyx Cynthia* is within or on the borders of the tropics. But the attempts now making ought not to be the less encouraged on that account, for they are producing a new raw material for thread and clothing within reach of men of skill and science, and 127,000 cocoons have recently been sent from Algeria to be manufactured in Alsace.

8. The extraordinary manner in which the *Bombyx Cynthia* multiply, together with the abundance of food for them, produced without culture in warm climates, renders the study of the habits of this insect and the nature of its cocoons of considerable importance.

9. I send herewith a small sample* of the cloth made from worms reared in Malta.

I have the honour to be, Sir,
Your most obedient humble servant,
WILLIAM REID, Governor.

Extract of a Despatch from the Governor of Malta to the Secretary of State. No. 83, dated 7th July, 1855.

* * * * *

6. It may be useful to state how the *Bombyx Cynthia* was successfully transported from Malta to the West Indies, after many attempts to bring it from India to Europe had failed.

7. Having first obtained the authority of the directors of the Peninsular and Oriental, and of the West India Royal Mail Steam Packet Companies, about 30 fresh cocoons were placed in bird cages, and suspended in the cabin of the surgeon of the steam ships. This was done that males and females might be kept together when the chrysalides became moths. In the moth state they required no food. On the voyage they laid their eggs, and these eggs began to hatch on their arrival at the Island of Grenada in the West Indies.

NINTH ORDINARY MEETING.

Wednesday, Feb. 3, 1858.

The Ninth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 3rd inst., the Right Honourable the Earl of Shaftesbury in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Everett, Frederick William	Rock, Thomas Dennis
Gray, Capt. William, M.P.	Williams, Alexander
Herapath, Spencer	Woods, Nicholas
Laxton, Henry	

The Paper read was:—

ON HOUSE ACCOMMODATION—ITS SOCIAL BEARING, INDIVIDUALLY AND NATIONALLY.

By Robert Rawlinson, Civil Engineer.

The paper now brought before the Society, is intended to direct attention to houses as they have been, to houses as they are, and to houses as they ought to be. The house accommodation of the masses will be principally considered, some of its defects will be pointed out, some of the resultant evils will be described, and certain suggestions for means of improvement and of sanitary regulations will be made. The question of house accommodation is far too comprehensive to admit of full discussion in the time allotted to one evening; and, therefore, disappointment may be felt that some particular branch of the subject has not been dwelt upon.

* This sample has been received, and may be seen at the Society's house.

House accommodation and house construction have received the attention of His Royal Highness the Prince Consort, and also the attention of many noblemen, gentlemen, and ladies, who have followed the good example set them. "Model houses" and "improved cottages" have been erected by societies and by individuals, with beneficial results most encouraging. To remedy all existing defects in houses of the poor in such manner, is, however, too much for isolated individual enterprise, and far too vast even for a free government. How, then, must the work be done? I will not attempt to give a full answer, but will content myself with pointing out some of the existing evils, and with shewing how wide-spread these evils have been, and now are, and then briefly indicate a few practical remedies. Improvement must, I consider, consist in inspection, and in regulation, by the local authorities, wherever neglect, filth, and disease exist.

Particular plans of improved cottages will neither be described nor recommended, not because their appropriateness and advantages are not recognised and appreciated, but simply because there is not time to discuss the whole subject. I may be asked, "Why, then, open up the question?" My answer is, that in this great and free Christian country, knowledge must precede beneficial change, and to inculcate the necessary knowledge there must be "line upon line, precept upon precept." Many good and able men have spoken and have written upon "the habitations of the poor," and many more good men must speak, must write, and must act, before the work will be even hopefully initiated. The question is one of health, of morals, of religion, and essentially one of national safety. If, as a nation, we will not work from higher and more Christian motives, our selfish fears may, in time, prevail. The health and life of a nation are in the masses.

A celebrated writer has said, if he might "write the songs of a people, he cared not who wrote their laws." I would say, "if I might house the people I care not who writes songs, or who enacts laws." Good citizenship is not from without, but from within. If men and women learn immorality from their birth, and in their homes are surrounded with vice as with the atmosphere, of what practical use can any secondary means prove? National schools, national reformatories—private schools and private reformatories—must alike fail. Gaols do not improve the morals of criminals, but notoriously render them worse. Gaols are actually looked upon by many criminals with favour, and not with dread. Cottages are not so clean, nor so airy, nor so warm, nor so healthy, nor so comfortable as prison-cells. I do not say "neglect the gaols," but I do say "look to the cottages, to the birthplaces, the homes, the true schools, and the only practical reformatories for the poor."

Historic Sketch of Houses.

The earliest form of protection for the human body from the effects of climate, would most probably be a "gourbie" or a tent. Caves would only be resorted to after crime had induced personal fear, and rendered seclusion necessary to personal security. The tent of the Arab is, to this day, as were the tents of the patriarchs. Types of house-construction may probably be found, in use, in one part of the inhabited globe or another, which faithfully represent every contrivance for shelter either invented or appropriated by man, from the burrow of the bushman to the "solemn temples" and "gorgeous palaces."

Invention and progress seem to be confined to a few of the many races of men, and progress, with permanence, has, so far as we know, as yet been the lot of none. The much-vaunted Anglo-Saxon race is only on its trial—and, if Lord Macaulay's prophecy should come true, we know its fate. Look abroad over the wide and fruitful regions of the earth, and we shall find retrogression in vast masses of the population, or superstitious forms stereotyped. As the Chinese were in ages past, so are they now. Throughout the East, generally, we find desolation or barbarism where civilization once reigned.

In these regions, from the earliest periods of history, and under every form of government, we find that the masses of the people have been badly housed, and hence have occurred plagues, pestilences, misery, and premature deaths. The history of man, with few exceptions (the Jews, Egyptians, Romans, &c.), down to the present time, is indeed one of neglect of sanitary laws, and consequently of retributive punishment. The Registrar-General points out weekly, quarterly, and annually, the national mortality, indicating the preventible excess, but, so far, to little practical parochial or municipal purpose, as compared with the work required to be done. Ignorance is fenced round with selfishness; the desire is to protect property and pocket; the results are ruin to property, and to health, and morals; the sacred name of freedom is invoked to perpetuate a state of things which breeds vice and engenders crime. An Englishman's house is said to be his castle. When Englishmen learn to keep their castles (that is, houses) so as not to destroy their own health, and render themselves, their wives, and their families a burden to the community, they may be left alone; but a man cannot be allowed to keep at large a savage dog, or a mad bull, to worry, to tear, and to gore the public. Why, then, should any man be allowed to generate and let loose typhus, small-pox, and other analagous diseases, to disfigure and to destroy? Lord Shaftesbury, by his Common Lodging Houses Act, has given the means to prevent disease, and to diminish immorality, wherever the Act is put in force, and the beneficial results are acknowledged alike by landlord and by tenant. Let there be such power of inspection, wherever contagious diseases break out, whether the house be that of a rich man or that of a poor man, and the results will be a benefit to all. Several towns have had public and private works of sewerage and drainage carried out with most marked beneficial results. But back streets, courts, and alleys remain neglected, room tenements and cottages (not common lodging-houses) remain overcrowded, unventilated, filthy, and breeders of fever. The parish authorities can only relieve distress brought about by preventible disease; they cannot, or they do not, remove the causes of the disease.

Houses as they have been and Houses as they are.

Central Asia—the birth-place of truth and of myth—the cradle of history—the land of contrasts—presents us with the oldest type of human dwelling; and what do we find but, side by side, the most wretched hovels and the most luxurious palaces? In the hovels we find the Arab-Egyptian (the Fellah), the "Ryot" of Hindostan, and the swarming masses of China, who all fare badly. A hut of mud, a roof of thatch, a floor of filth, hovel and clothing abounding with parasitical vermin, where skin diseases, ophthalmia, along with other analagous complaints prevail. From generation to generation there has been, and there continues to be, the greatest amount of misery to the greatest numbers. The tropical sun shines down upon filth, upon squalor, and upon disease. The vulture, the stork, the dog, and the hog scavenge the streets and suburbs as of old; and at a glance you may see that the existing dog of an Eastern city is a lineal descendant of those dogs which licked the blood of Ahab, and ate the carcase of Jezebel beneath the wall of Jezreel. Plague ever broods over these sites, and cholera sows its subtle but death-producing seeds in the face of the sun, to be wafted wide as the atmosphere, to kill wherever there is degraded man, living amidst filth, foul-air, and wallowing in sin.

The Russian serf is miserably lodged; the habitations are of rude materials, are primitive in form, and wretched in accommodation. Over the continent of Europe, generally, the poor are lodged in mere hovels, with de-

fective means of sunlight, with defective means of ventilation, and filthy alike internally and externally. Examine the tenements of Germany, of Denmark, of France, of Italy, of Portugal, of Spain, and of the other kingdoms, and you will see the appropriate residences of ignorance and superstition; the fitting birth-places of wild turmoil and anarchial revolution.

But, as Englishmen, let us look nearer home,—let us blush and sorrow over the mud-hovel of Ireland, the "boothie" of Scotland, the country cottage, and the room-tenement of England. I have seen these places, and have witnessed sights I cannot describe, and human misery the pen fails in power to depict. The story of this source of national deterioration has been told recently by many able men, as may be found in despised blue-books, and in literature not popular.

If we look to our mediæval history we find that our cities, towns, and villages, for the most part, were composed of hovels with mud-walls and with thatched roofs. Mud floors were covered with rushes or straw, which remained until the compost was rotten to corruption. Houses were without order or regularity. Streets, in cities and in towns, were narrow, dark, and tortuous; the subsoil was without sewers and drains; the streets were without pavements or lights. Dogberries watched but did not ward, bravoes stabbed, burglars plundered, and nimbler thieves "cut purses." The only remedy known to the magistrates consisted in loading gibbets, and in "stringing sturdy rogues to the gallows apace."

Time rolls on, and "merry England" grows into the improved state depicted in Swift's "City Shower." Parts of cities and towns had then pavements and surface gutters, but no sewers. There are now pavements, sewers, cleansing, lighting, and watching more generally; but many a poor man's cottage, and many a room tenement receive no adequate benefit. There is scarcely a city, town, or village in Great Britain in which there are not to be found some houses and some rooms into which the sun seldom shines: into which a breath of fresh air seldom blows. There are courts closed all round; alleys not two yards wide; rows of cottages, back to back; rooms without window or flue; cellars, with ceilings below the level of the ground; attics in which a child cannot stand upright, and inhabited human dens too foul for wild beasts' lairs.

There are many reasons for the utterly degraded state of this portion of our poor. Centuries of neglect and of seasoning have blunted the natural senses to the taint of foul air; as, most frequently, the only industry shown is to block out fresh air, to secure heat—and when we find thousands of men, women, and children in our towns, barely covered by a few filthy rags, inhabiting rooms without furniture, lying on rags, or on tainted straw, with no adequate food, and no certainty of a second meal, except by begging or by stealing, we should judge their ignorance of sanitary laws lightly, and deal gently with their transgressions, as most of these poor creatures never had a chance given to them of knowing better or of being better. They cannot build houses, they cannot furnish a single room, however small; they cannot understand the laws of nature; they cannot appreciate oppressive sanitary rules, when arbitrarily enforced. They are hungry, and wish to eat; they shiver in the cold, and wish for warmth; they are exposed to the bitter elements of a severe and varying climate, and they wish for shelter. A living body is warmer than a naked wall or bare floor, and hence overcrowding is considered a desirable thing. They feel and appreciate the warmth, but do not see the subtle poison; and, in fact, the carbonic acid deadens the senses, and induces oblivious repose.

The reports drawn up by the Inspectors of the General Board of Health and others detail case upon case of defective house, and of improper room, accommodation. I could add proof upon proof, from personal inspection, of the discomforts, sicknesses, and miseries endured by the poor who reside in cellars, damp, fœtid, and dark at noonday; or who huddle together in room tenements which are without furniture, the floors rotten, the walls blackened with filth, the ceilings hung with webs of spiders, and out of which rooms fresh air is, as much as is practicable, excluded. There are the rubble walls of the north, the porous bricks of the midland counties, the "cob" walls of Devonshire, and the rotten timber and shingle of some of our seaports. Out of these places proceed fevers; and upon them settles cholera. Into them goes the parish money, as the relieving officer and the parish surgeon cannot long be absent. The rent is paid by the parish many times over, and not unfrequently more than the purchase money is expended in one year. There are room-spaces, of the most wretched class, which annually cost a parish more to maintain than any equal area in Windsor or in Buckingham Palaces.

The Registrar-General has stated that the tendencies of modern civilisation, in this country, are to mass men into towns. In 1841, the population in 117 districts, comprising the chief towns, was 6,612,958 souls. In 1851, in the same districts, the number was 7,795,882, being an increase of 1,182,924 in ten years, or about 18 per cent. There is a corresponding increase in the rates of mortality, although in some cities and towns there have been many sanitary improvements. As towns increase, there is an engulphing or lowering of whole streets and of entire districts of houses, built originally for the merchant and superior tradesman. Examine some of our great sea-ports and inland manufacturing towns, and it will be found that streets of houses originally erected for "the merchant princes" are now in ruins. From having been the abodes of those possessing wealth, they are now the abodes of the improvident, of the vagrant, of the vicious, and of the unfortunate. The quaint carving on the stone-work looks out of place, the walls are half in ruins, the gables are shattered, and foul weather-stains of damp blotch the surface. Within, matters are even worse; the rooms are now divided and sub-divided on every floor; the staircase is darkened, its massive hand-rail and carved balusters are crippled and broken, the once firm stairs are now ricketty and dangerous; the stucco-finished plastering is blackened and in holes, the dusty and rotten laths being in many places bare; the landing-windows, when the space is open, have neither frame nor glass, so that the rain drives in right and left; make-shift doors lead into small spaces let off as separate tenements. The narrow space of street betwixt the houses is further contracted by rude looking poles rigged out of windows on either side, story above story, on which clothes are hung to dry; thus, externally, a free flow of air is impeded, and an atmosphere, usually very damp, is made more so. In the same street houses may be found which were erected in Queen Elizabeth's reign, with others of more modern date; the walls are of hewn stone, of bricks, of timber framing, of limestone rubble, or of other material. Some have been plastered, and others have been covered with slates; some have plain vertical fronts, and others project at each story. Out of these streets covered passages lead into still narrower, dirtier, and more crowded courts. In many instances the ground rises abruptly, and slippery half-worn steps lead to houses more ruinous and more crowded than those fronting the streets. One privy serves for a whole court, and this is usually filthy; the cesspool full, overflowing; the fœtid refuse stagnant over the surface. An external stand-pipe, the water on only for one hour in twenty-four, supplies water to an entire court with many tenants; tubs, mugs, pots, pans, and troughs, being placed in yards, on stair landings, or in the filthy rooms, to absorb all the deleterious gases of the places. Within the furniture accords with the premises; it is old, rotten, broken, and ruinous. One room serves for a family of father, mother, and children, not unfrequently grown up sons and daughters. Dogs and fowl inhabit the same small apartment, and in some instances ten

human beings. In gaol each criminal has, at the least, one thousand cubic feet of fresh air secured, and the air in this space is regularly, evenly, and many times changed during each day. The inhabitants of room tenements, of country cottages, of Scotch boothies, and of similar places, have frequently not one hundred cubic feet of air space, and this air is never changed, but by the natural law of diffusion of gases, the deleterious carbonic and sulphuric acids are allowed to perform their fatal work.

There are many defects in old and in modern villa and suburban houses, such as improper site for detached houses, in the country or in the suburbs of towns. The site may be a swamp, an undrained hill side, or even a hill top. The sewerage and drainage may be defective; the plan may be confused; the rooms may be too low; the doors, the windows, and the fire places may be improperly placed; and means for ventilation may have been entirely neglected. The pump and the cesspool may communicate, and pipes, and gutters, and cisterns of lead, may add that deleterious metal, in solution, to the water used for domestic consumption. There are few country or suburban houses, even of the better class, entirely free from some one or more of these defects, no not even the mansions and palaces.

Having glanced at houses as they are in courts, in lanes, in alleys, and in the back slums of towns, and at some of the defects of those in their suburbs, we will now look at some houses as they are in the country throughout Great Britain.

Cottages.

Look at these structures called cottages. They are mere hovels of mud; or of "wattle and daub;" or of rubble stone set in mud; or of rude timber frames filled in with mud, or with brick, or with stone, or with other material. The timber is rotten; the mud, bricks, and stones, are damp in wet weather, and dusty in dry weather. Look at the site; probably a hole; not unfrequently a swamp several feet below the adjoining road, the slope being towards the door. If on an elevation, the ground is unformed, rugged, abrupt, uneven, and neglected. Many of these hovels are only one story in height, the side walls are very low—from three to six feet up to the square—few are vertical and some are supported by buttresses or by props. Many are half-buried against a hill side, or against a bank which is wet.

Then the roof. This is thatch of heather or of straw; or is formed of turf, of sods, or of shingle, of tile or of slate. If of thatch, the material is rotten with age, and green with fungoid vegetation; if of shingle, the timber is decayed; if of slates or tiles, they are broken and in holes. Doors and windows match the structures, and the floor is native mud, the space enclosed being common to bipeds and to quadrupeds alike. The floor is not only very dirty, but the walls, roof, and furniture are the colour of grimy dirt. Amongst the rafters, spiders and other insects abound. Outside, animal refuse is stored in some hollow where liquid permanently rests, so as to keep up evaporation and an evolution of gases, highly injurious to human life, and if this refuse does not actually surround the hovel, it is frequently so situated that the prevailing winds shall drive the gases of decomposition into and through the habitation. The arrangements for disease, misery, and premature death are ample, adequate, and complete. The hovel is crowded by males and by females of all ages, without means of separation, so that the arrangements for sin and misery are also complete. Morality is consequently at a low ebb. How can it be otherwise? Look at the country in which these hovels are situate. There may be the grand old mountains of Wales, fragrant with heather and wild flowers; there may be the glorious lake scenery of Cumberland; or there may be the graceful undulations of the midland counties, agriculturally rich beyond the romance of fable,—trees, corn-land, and grass-land blending harmoniously; or we look over the wolds of the chalk and oolitic district, open in broad rounds and valleys, dry and comparatively bare of trees, but, nevertheless, yielding rich herbage and fine crops. Such hovels as I have faintly attempted to depict may be found in landscapes such as I have most imperfectly attempted to describe, but the houses are neither ornamental nor useful, although artists persist in designating them picturesque. There are not only agricultural hovels, but there are sea-side fishermen's hovels, and out-of-the-way miners' hovels. They are, however, all of one type, and are too frequently nests of filth, of foul air, of sickness, of immorality, of human degradation, and of human sorrow. The parish doctor knows the inhabitants; they consume his time and his physic. The relieving officer knows them—they empty the public pocket. The parish constable knows them—they are his most turbulent customers. The gamekeeper knows them, as frequently they are poachers. The magistrates know them—they commit petty thefts, and produce bastardy cases innumerable. The minister of religion knows them, as most assuredly amongst these people his principal work lies. The charitable know them—ladies, beautiful, delicate, and good, visit, sympathise, and relieve.

"Hovels, and their inhabitants, as they are," such as I have tried to describe them, are known and they are unknown. They are known to artists, to parish surgeons, to constables, to gamekeepers, to some clergymen, and to benevolent ladies, but they are, for the most part, unknown to parish guardians, to town-councillors, to country squires, to imperial legislators, to the general public, and to very many landowners. By some landowners their existence is considered to be an incumbrance. Cattle have value for such persons, but not human beings.

Scotch Highland and Island Boothies.

The cottage, boothie, or hut in Scotland is a barbarous shelter. Many of those in the highlands and islands are mere hovels, rough in the materials used, and rude in the form of construction. The side walls and gables are of dry rubble stone, peat, or mud; the covering is thatch, mud, or sod, often a jumble of material, plastered, piled, weighted, or tied on. The door is low; a mere hole serves for window; and a hole in the roof lets out a portion of the peat fire smoke. There is no flue, and, consequently, when the fire smokes, there is a general distribution of smoke with the heat, so that a philosopher may study the law of "diffusion of gases" visibly. Smoke not only rises through the hole specially left for its escape, but pours out of door, window, and also out of every crack and cranny in roof and side wall. A stranger might easily imagine that the boothie was on fire, or mistake it for some charcoal burning apparatus or kiln. The inside of one of these boothies is a curiosity. There is an attempt at division, and beds are made up in recesses of the smallest dimensions against the damp walls or bank, and closed in by the aid of peat, hurdles made of heather, or some equally rude contrivance. If there are ceiling joists, a loft is made in the roof, to be reached, not by stairs, but by a ladder, and this may be a general store or a bed-room. Most frequently the natural earth—be it rock, mud, or peat, forms the floor, full of holes, worn and uneven. Pavements may be found of rude flags or pebbles, or a mixture of both. Many boothies give shelter to cattle and other animals which man retains for his use—quadrupeds and bipeds—such as dogs, pigs, ponies, ducks, fowls, &c. They may enter all by one door, or there may be a separate entrance under one roof. Inside and outside these places there is dirt and neglect. The very spirit of thrift could not, in fact, keep such places clean. Smoke is as the breath of life to the residents, damp and dirt an institution.*

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* Up to the early part of Elizabeth's reign, cottages in England generally consisted of a single room, and chimneys were unknown in such dwellings. Up to the end of the 13th century,

We censure the poor for their indulgences, but what says that close observer of human nature, Sir Walter Scott. Listen to the antiquary and the village fish-wife, after the bargaining for the fluke and the cock-paddle.

Monkbarns says:—

"Half-a-crown, then, Maggie, and a dram."

"A weel, your honour maun hae't your ain gate, nae doubt, but a dram's worth siller now, the distilleries is no working."

"And I hope they'll never work again in my time," said Oldbuck.

"Ay, ay,—it's easy for your honour, and the like o' you gentle-folks, to say sae, that hae stouth and routh, and fire and fending, and meat and claith, and sit dry and canny by the fire side,—but an ye wanted fire, and meat, and dry claise, and were deeing o'cauld, and had a sair heart, whilk is worst ava', wi jist tippence in your pouch, wadna ye be glad to buy a dram wi't, to be eilding and claise, and a supper and heart's ease into the bargain, till the morn's morning?"

Charity is inculcated in the Scriptures; and it must not be denied that charity is necessary to Christianity. But there are many forms of false charity, and some of these forms are demoralising. It is not charity which leaves a labourer and his family in some wretched cottage or hovel to contract and to endure fever, and then relieves him with wine, jellies, and similar delicacies. It is not charity to allow the poor man's home to be all discomfort, so that the ale-house leads him from bad to worse, until a gaol receives him from the esquire's sentence, and then for the esquire's lady and daughters to carry or to send relief to a broken-hearted mother and starving family. Soup-kitchens, charity bazaars, money clubs, clothes clubs, dispensaries, and personal visits to distribute money or food, are not to be denounced; but they should all be secondary, and not primary; the duty of the rich is to help a poor man to help himself. Firstly, by providing comfortable and healthy homes; and, secondly, by living such a life as shall be a good example: a clean, well-ventilated, and well-drained cottage, with good water, and a small garden, at a moderate rent, should be provided for all. A case of fever should lead to an immediate inspection, and to immediate sanitary improvement; other forms of relief may then be consistently offered. It is a mockery, if not worse, to allow a man to inhale poison, and then to offer him sympathy: intoxicating drinks and delicate food do not cure fevers, but fresh air and wholesome water, with plain food, well cooked. Promote means of health, promote means of industry, and promote habits of forethought and habits of economy; add to this relief to the aged, and especially the afflicted, that blessings may rest on the giver and on the receiver. Many richly endowed charities are a perpetual curse; many so-called charitable people sow the means of vice broadcast; schools, churches, union workhouses and gaols, will neither cure nor even reduce the evil; there must be the means of health and comfort, with a chance of virtue, in every British home before men can be Christians.

Ventilation of Houses.

Many volumes have been published on the subject of ventilation, and many patents have been granted for apparatus to effect ventilation; and yet, one of the evils most common, both in public and in private buildings, is defective ventilation. How is this? The nature and properties of the atmosphere have been accurately described over and over again, and correct means of ventilation are lucidly set forth by more than one author,—from Count Rumford to Dr. Arnot; but, somehow or other, the right knowledge does not get into the right heads,—hence all the neglect or blundering, all the mischief, and all the consequent misery and inconvenience. With the wheat of knowledge there is a vast amount of the chaff of ignorance and of advertising quackery. Architects and builders must be very young birds indeed, if they are caught by the chaff—in nine cases out of ten, if they are caught at all. But the truth must be told, namely, that few architects make ventilation a special study, and they consequently neglect alike both wheat and chaff; ventilation has not been "in the bond;" they design and build a house, having doors, windows, fireplaces, and chimneys; but there is no warranty given that the rooms shall have full and free means of ventilation, independently of doors, windows, and ordinary chimney-places, or even that all the flues shall draw. Will it be improper in time to come to ask for such warranty? All rooms ought to be ventilated,—all chimneys ought to draw. The task may be difficult, but it is not an impossible one; smoke obeys the simple law of nature under all circumstances, and on all occasions; it never comes down, when it ought to go up, without good and sufficient reason; if there is fault, it is in the building or in the architect, and not in the smoke. It may be pardonable to attempt once more, probably in a more bungling manner, that which has been so often and so well done by some of the great men alluded to, viz., to explain some of the properties of the atmosphere.

Air is a substance highly elastic, but, under equal temperatures, its bulk and gravity are tolerably permanent.

Heat expands air, causing it to occupy more space, and hence heated air is lighter in proportion to the heat imparted to it.

Warm air, being lighter, rises into and through colder air; and cold air, being heavier, descends into and through warm air, that is, the warm air in a room and chimney rises into colder air outside, and there is a tendency in the cold air to descend into the warmer air of the room, even down the chimney, if the balance of the draft is not in favour of an upward current. When rooms contain air several degrees of heat above the external atmosphere, this colder and heavier external atmosphere presses in to restore the balance, through every chink and opening; hence the cold drafts experienced in winter.

To maintain combustion air is necessary; hence the abstraction of air by all fires, and the necessity of chimney-flues to remove the heated products of combustion.

All rooms are reservoirs of air; they contain so many cubic feet, according to their dimensions. A room 10 feet long, 10 feet broad, and 10 feet in height, contains 1,000 cubic feet of air, at all temperatures, neither more nor less. But, as air is expansive and is expanded by heat, 900 cubic feet at a low temperature may be heated until they are increased in bulk to 1,000 cubic feet at a higher temperature. In this case, as there is one-tenth less of substance, there is also about one-tenth less of weight, and one-tenth less of the chief ingredient to nourish life. The warm air is one-tenth lighter, but in each case the room is full of air.

For the sake of illustration, we will compare the room full of air to a cistern full of water (though water is practically non-elastic). Then, to maintain either a room full of air, or a cistern full of water, if provision is made for drawing out (or abstracting like a chimney-flue), provision must be made for letting in. If doors and windows fit tight, and there is no other means of admission, it will be practically impossible to abstract air by the fire and chimney-flue from a room for any length of time. The operation could not go on for an instant, but by reason of the elasticity of the atmosphere. Few rooms have doors and windows, walls, floor, and ceiling perfectly air-tight, and hence a fire is burned at the expense of cold drafts, wherever external air, in winter, can find entrance. This is generally under the door, through the skirting and floor, and so along to the fire-

castles (or baronial dwellings) were literally fortified places, in which the convenience of habitation was sacrificed to purposes of defence. It was not till the 15th century that barons resigned the security and gloom of their castles for the comparatively greater comfort and convenience of castellated houses.

place. Who does not suffer from cold feet in winter, especially during frosty weather?

Small rooms, having less air to pull upon expansively, frequently smoke by puffing down-drafts in the chimney. The fire forces air up the flue, until the air is too highly rarified, and there is practically a partial vacuum; cold air then descends the flue to restore the balance, forcing some of the heated air and smoke with it. Large rooms, as a rule, are more easily warmed, and are freer from draughts than small rooms.

There is one form of evil connected with houses, namely, the admission of foul gases from sewers, drains, or cesspools, which, being unseen, may remain unrecognised, although much sickness and many premature deaths may occur in consequence. At all times when the internal temperature of any house is higher than the external air, there is an active exhaustion caused by the fires up the chimney, and there is a drawing or pumping power within the house, and sewer and cesspool gases are drawn in from every crack and from every cranny. The mischief of such a state of things is very great. In forming sewers and drains, this contingency should never be lost sight of. Defective sewer and drain connections are a source of mischief both winter and summer, as in winter the foul gases are drawn in, and in summer sewer gases (sulphuretted hydrogen) and others, which are lighter than common air, flow in. Many persons think that houses situate on a hill, or having a rapid fall for the drains and sewers, must necessarily be easily drained, this is a mistake; there must be special and ample provisions for external ventilation from the sewers and drains, or the gases from lower levels will flow up and into such houses. Water, by reason of its weight, which is greater than atmospheric air, flows down hill with velocity proportionate to the slope and to the friction; sewer-gases, by reason of their gravity, which is less than atmospheric air, flow up-hill with velocity also proportionate to the slope and to the friction. It is of the utmost importance that these facts should be remembered.

There is the law of "diffusion of gases," by which gases diffuse throughout other gases and throughout atmospheric air. If this law were annihilated, the present order of animal creation must cease to exist. It is the diffusion of gases which renders a hut, boothie, cabin, room, common lodging-house, or modern drawing room, tolerable during excessive crowding. The poor over-crowd their wretched apartments partly from ignorance, but more from stern necessity. The wealthy crowd a modern drawing-room partly from ignorance, but more because it is fashionable. The mischief is alike fatal in both cases. At a dinner table we have our plates and knives and forks changed, and use separate glasses for purposes of drinking, but in a crowded drawing-room, and in a crowded ball-room, we breathe and re-breathe the waste products of our own and of each other's lungs, vitiating and re-using the air in common, a process far more injurious to health than using plates and glasses in common. Ventilation, free and abundant, should, in all cases, be provided for. But no amount of ventilation will do away with the evils of overcrowding. An overcrowded hovel, or an overcrowded drawing-room, is only an evil in a lesser degree, if even their ceilings and their roofs could be removed.

The following extracts from Reports by the Inspectors of the General Board of Health will give some idea of the sanitary condition of the dwellings of the poor in the towns named.

The supplement to the report on Whitehaven, dated 1849, contains tables of the "room-tenements" and "cellar-tenements" within the district, and states that "the buildings are in a ruinous condition; the staircases are of wood, frequently dark, confined, and rotten or out of repair. Where the beds are described as 'old and dirty,' they are upon bed-stocks, but very few of them have anything to cover them with but a bundle of old rags. Those beds, named 'rags and straw,' are on the floor without bed-stocks, and without proper bedding to cover them with; the bed-clothing, if any, a bundle of rags. Many of the rooms are swarming with vermin; disease and fever prevail throughout."

Out of 315 room-tenements, inhabited by 1,369 persons, there are 256 described as being without means of ventilation. The beds in 83 of these tenements are composed of "rags and straw," and nearly the whole of those in the remaining tenements come under the headings of "dirty," or "old and dirty."

Out of 191 cellar tenements, occupied by 716 persons, not less than 177 are stated to have no means of ventilation. "They are damp and dirty to a degree not to be described; a heap of dirty straw or rubbish constitutes the only form of bed in most cases, and this is laid on the damp floor in one corner. The confined smell and fœtid atmosphere are most offensive, and almost suffocating to any person entering. They have no privies, or convenience for ashes, but the inhabitants get rid of their refuse as they best can, most frequently immediately in front of their door." It may be added that 12,000 of the inhabitants, or two-thirds of the entire population, were, at the date of the report, without any privy accommodation.

In the report on Gateshead, speaking of the dwellings of the poor, the Inspector says,—

"Neither plan nor written description can adequately convey to the mind the true state and condition of the room-tenements, and of the inhabitants occupying them. The subsoil on the sloping side of the hill is damp, and most foul; the brickwork of the buildings is ruinous, the timber rotten, and an appearance of general decay pervades the whole district. The buildings, originally erected as residences of a superior description, have single rooms let off as tenements, which are crowded with men, women, and children; the walls are discoloured with age, damp, and rot; the windows are broken—old rags, straw, and boards, occupy the place of glass, so that means of light and ventilation are alike absent. There are no sewers nor drains, neither is there any proper (privy) accommodation; solid filth encumbers the surface; liquid refuse saturates the subsoil, and is drawn by capillary attraction through the porous bricks up into the walls; personal cleanliness or a healthy atmosphere is impossible."

In the Report on Dover, the following evidence of the relieving officer of the district is given:—

"The largest proportion of out-relief distributed in the worst portions of the district is caused by fever, small-pox, and other similar complaints, such being very prevalent in these localities; caused, I have no doubt, to a very great extent, by the closeness of the buildings, and their filthy state, from want of proper drains and other sanitary regulations.

"From the experience of upwards of ten years' intimate connexion with the poorer classes, I have not the slightest hesitation in affirming that there is a most decided direct connexion betwixt confined districts, bad sanitary arrangements, and poverty and vice. In the worst districts the moral state of the inhabitants is most deplorable,—as the youth from these places grow to manhood they become habitual thieves or paupers; brought up to no regular employment, grossly ignorant and reckless, their time is spent between the gaol and the union workhouse. I can only say that if the Government wish to prevent the increase of a most debased and vicious population, they will take measures, if not to sweep away these nests of vice and disease already built, at any rate to prevent similar places from being erected in future."

The Rev. T. W. Darwell, curate of St. James's parish, Dover, says—

"My own observations and experience in visiting among the poor, tend most decidedly to confirm the evidence that better sanitary regulations would tend very materially to improve the habits of the peo-

ple. The poor man, when fatigued, cannot be expected to remain in his house, if his wearied senses are to be oppressed by noisome stenches and disgusting objects. He naturally seeks the beer-shop as a refuge, and his wife and family are left to seek relief, under such circumstances, as they may. Thus the domestic bond is loosened, if not severed; he ceases to regard his family, and they cease to respect him, and so a generation of reckless and unprincipled persons is by these means turned out upon society."

The Rev. J. Puckle, Incumbent of St. Mary's, Dover, in a letter addressed to the superintending inspector, in 1848, says—

"From a ministerial experience of 13 years, I am perfectly satisfied of the close connection subsisting between the sanitary and the moral condition of our poorer classes. I have found, without any exception, the worst demoralization in the worst constituted dwellings and neighbourhoods, the one being traceable from the other, directly, as effect from cause. To what extent we may ever succeed in raising the moral tone of our poor people's habits of life, time only can show; but I affirm, in conscience, that to raise them while they live in such places, and under such circumstances, is impossible."

The relieving officer, of the Falmouth district, in his evidence given before the Superintending Inspector says, "I pay in out-door relief from £8 to £9 per week in the district; in the town of Falmouth about £5 a week. Have seen fever in the places I visit. Pay most relief in the worst places. Sometimes continue payment five or six weeks to one family, and as much as seven or eight shillings a week. Much of this disease might have been saved, if fever could have been prevented. See much misery. The people do not complain so much as we complain of the nuisances. Had extra relief to pay for cholera in 1848 and 1849, and pay to this day (1854) to some of the families made paupers by the cholera."

The medical officer to the Falmouth Union states—

"Fever prevails in most of the courts. It is invariably found with dirt. Where there are defective ventilation and bad drainage, there we get fever. Many of the bedroom windows will not open. The rooms are about twelve feet by ten feet, and seven and-a-half feet high. Ten persons occupy such rooms. Have been obliged to knock out a square of glass in a window to get ventilation. This overcrowding lowers the standard of morality. Much disease is traceable to intemperance. Men are driven from an uncomfortable home to the public house."

The following extracts from the "Report of the Commissioners appointed to inquire into the causes which led to, or which aggravated the outbreak of cholera in Newcastle-upon-Tyne, Gateshead, and Tynemouth," show the sanitary condition of the dwellings of the poor in those towns in 1853.

Speaking of Newcastle, the Commissioners say:—"There are considerable districts, especially in the lower and older parts of the town, in which almost all the houses are built back to back, so as to be incapable of thorough ventilation, and with their fronts within so few feet of one another as to render it almost impossible for sunshine, wind, or rain to reach directly even their exterior walls; many of these miserable lanes or entries being, moreover, closed up or covered over at one or even at both ends.

"That, on entering some of the houses in such localities, during our day-inspections of the town, we were arrested at the door by a darkness which was little less than total; and medical officers are sometimes under the necessity of taking a candle, in order to see their patients in some of the rooms in these places, even at noonday, and in the height of summer.

"That the poorer inhabitants are not only very ill-lodged, but exceedingly over-crowded in their lodgings. That about half the families in the town are confined to the occupancy, or joint occupancy, of exceedingly over-crowded single-room tenements. That in September, 1853, cholera broke out in rooms in which as many as twenty to twenty-five occupiers were congregated; there being only fifty cubic feet of space or air (furniture, &c., not considered) for each individual. That, in consequence of the frequent ill-construction, ill-ventilation, and over-crowding of the habitations of the poorer classes (as well as the want of sewerage, drainage, proper domestic conveniences, and other matters), the condition of many of the tenements which form the residences of about three-fourths, and especially the condition of many of the single-room tenements which form the residences of about half, of the entire population, has habitually been 'filthy and unwholesome,' even where not technically described as 'unfit for human habitation;' that the stench experienced on entering some of them is in the highest degree offensive; and that the effects upon the health of the inmates, and of the vicinity generally, can only be equalled by the corresponding effect upon their morals and sense of decency."

The Commissioners state that there are are 15,000 families, or not less than two-thirds of the population of the town, who have no right of access to a private "privy;" and that ash-pit accommodation is almost equally deficient.

The Commissioners close their report, as regards Newcastle, with a statement of the pecuniary loss sustained by the ratepayers, as the result of the outbreak of cholera. "The Board of Guardians expended, for immediate services, about £4,000; between £6,000 and £7,000 were expended under the supervision of the Vicar; an excess of at least £3,000 above the usual expenditure for sick and funeral monies was incurred by the benefit societies; £500 were expended by the Town Council; an annual expense of about £2,600 was incurred by the Board of Guardians, for the maintenance of widows, orphans, and others, which at only eight years' purchase would be worth some £21,000; making altogether an expense of some £35,000, or thereabouts, over and above the very serious loss to the town from stoppage of trade, &c."

With regard to Gateshead, the commissioners state "That the same radically bad system of house-construction, described as prevailing in considerable districts of Newcastle, prevails also, and probably to a larger extent comparatively, in Gateshead; that a large proportion of the houses occupied by the poorer classes (who apparently constitute four-fifths of the entire population) are built back to back with one another, or, where not actually back to back, with backyards between them so small as to serve only to receive accumulations of filth, and to be quite inadequate for wholesome ventilation; that the spaces between the fronts of these back-to-back rows of houses are so narrow as to render it almost impossible for either sun or wind to get at them, and to render them habitually dark and unwholesome; that one or other end of these narrow alleys is not unfrequently closed or built up, whilst in some cases, smaller lateral *culs-de-sac* are found leading out of a larger one; the other ends of these miserable places being also sometimes built over, so as to leave nothing but a single covered way for ingress or egress; that in other cases the houses are built into the abrupt riverward slope or bank, so as to have one or more of the walls, for one or more stories in height, in close proximity with the earth of the acclivity above—while in some instances both these evils are combined, and in this way, throughout considerable districts, chiefly occupied by the poorer classes, ventilation is rendered almost impossible.

"That a large part of the dwellings of the poorer classes are not fit for human habitation; that at least one-half of the population of Gateshead is thus dangerously mis-lodged; that a considerable part of those dwellings are not only not fit, but incapable of being rendered fit for such a purpose.

"That the poorer classes of Gateshead are not only exceedingly ill-lodged, but also much overcrowded in their lodgings; that it is an habitual thing for an entire

family to live, sleep, cook, eat, wash, &c., in a single room; the corners of single rooms thus occupied, being occasionally further sub-let to other families or lodgers." With regard to privy accommodation, the commissioners state that Gateshead is as deficient as Newcastle, whilst in one point it is even more deficient, viz., in not having a single public privy.

With reference to the cost of the epidemic in Gateshead, the commissioners say "That an expense of about £1,278 was incurred by the Board of Guardians for immediate services; that a public subscription of about £600 was similarly expended; that an annual expense of about £450 was incurred for the maintenance of persons thereby rendered chargeable to the poor rates, which, at only six years' purchase, would amount to £2,700; so that, without considering the loss arising from stoppage of trade, &c., the cost of the outbreak amounted to some £4,600."

Conclusions.

A close study of house accommodation, especially for many of the poor, not only of this country but of all countries, has led me to the following conclusions:—

That, as a rule, men so construct their habitations as to vitiate the common atmospheric air, rendering the free breath of life a fruitful source of disease.

By placing houses on improper sites.

By leaving those sites unformed, undrained, unpaved, and uncleansed.

By using improper materials for houses, and by adopting unsuitable plans.

By totally neglecting adequate means to secure ventilation.

By overcrowding, by indiscriminately mixing the sexes, and by allowing the adoption of habits of filth.

That the results in all ages have been fevers, plague, and all the analogous diseases which destroy infant life, and which cut off mature adults.

That there may be portions of the earth's surface unfitted for the use of man, but that, as a rule, the sources of disease are not so much in countries, in climates, in sites, in elevation, in density of population, or in any other external cause, as within the walls and beneath the roofs of the houses and tenements. Masses of people, living contrary to the simple laws of nature are necessary to decimating epidemics, and not peculiar climates, geological formations, great rivers, river deltas, inland plains or mountains.

That fresh air is the first requisite to health, and that any houses which do not admit of fresh air being breathed by the inmates—waking and sleeping—are defective in construction, are also defective in arrangement, and probably most defective in personal management.

That the poor of this country cannot provide themselves with houses suitable to health, but must inhabit such as are placed at their service.

That many of the poor, and many working men, can afford to pay a sufficient rent for healthy cottages or rooms, if they had a choice betwixt good and bad cottages and rooms, or could obtain healthy places of residence.

That, in many instances, the losses caused by defective house accommodation are either direct, or indirect, charges upon parishes. Foul air induces fever; fever destroys adult life, and then widows and orphan children become a parish charge.

Remedial Measures Proposed.

That in parishes, corporations, or in separate districts, there shall be an Inspector of Nuisances appointed; but that several small or poor places may be combined under one inspector, with the sanction of the General Board of Health.

That upon an outbreak of contagious fever, small pox, or other zymotic disease, the parish doctor, local medical officer, or local inspector of nuisances, shall have power to inspect the premises, and report to the local authorities.

That there shall be local power to insist on proper means of ventilation to all cottages and room tenements; and that lime-washing may be ordered, or may be executed by the parish authorities, the cost to be recovered from the landlord.

That subsoil and surface draining may be ordered, or may be executed where required.

That every room appropriated for human habitation shall have, at the least, one door and one window, capable of admitting sufficient light, and that such window shall be so constructed as to open so as to allow of full ventilation.

That there shall be sufficient "privy" accommodation to all houses and tenements, of not less than one seat to each ten persons.

That there shall be means of external ventilation and sun light to all dwelling-houses.

That there shall be means for a separation of the sexes in all houses and in all room-tenements.

An improvement in the law so as to facilitate the sale of land for house building purposes, would afford means for improvement.

In new buildings, rooms to be inhabited should not be less in height from floor to ceiling than nine feet vertical.

All houses should have the roof eaves spouted; and all yards, courts, and passages in the immediate vicinity of houses should be paved, or flagged, and surface-channelled.

I have briefly and imperfectly treated a most important subject, and must now leave the question of improved house accommodation to the consideration of our legislators and thinking men. The problem of house accommodation deserves to be worked out. If defective houses were only inhabited by the poor, remedial measures would be imperative on Christians; but the case is more hopeful. Very many families earning good wages (from £1 to £2 per week) can obtain nothing better in which to live than a wretched hovel, a cottage in a blind alley, or a house up a narrow and dark court, or some miserable rooms or single-room tenement. The prices charged and paid vary from 2s. 6d. to 5s. 6d. per week; in the one case, £6 10s., and in the other, £14 6s. per annum. It is practicable to build cottages in the country and in small towns, having four rooms, for a rent of £6 10s. per annum, and blocks of houses in towns and cities, of equal accommodation, for a rent of £10 per annum, the common rate of interest being received in the form of rent; such houses to be properly sewered and drained, to have wash-house and drying-ground—in common to, say, ten such tenements,—to have a full supply of good water, to have "privy" accommodation adequate to privacy and decency, and to have means for ventilation and light to each room. In the country, garden allotments are a comfort, a source of profit to landlord and to tenant alike, and a great blessing to the provider and the user. Ornamental cottages, if the ornament is costly, are not required. Improved dwellings and cottage allotments should not be made into show-places. An honest poor man does not require petting, but opportunity to be a good Christian, and to live by labour. He is sure, under such conditions, to be a good citizen.

Human society, to be stable, must be like the pyramid; the foundation must be broad, and it must be secure. The mystic priests of Egypt expressed their ideas in symbols, and I am not sure the pyramid was not intended to symbolise the construction of a nation. The broad, spreading base—the people; the diminishing, but rising courses—the middle classes; the upper courses—the nobility; crowned by the kingly apex—forming the only practicable finish to a symmetrical, secure, and enduring structure. The idea may be a vain fancy; but if Great Britain is to endure—if our civilisation is to progress—if our religion is to bear appropriate fruit—if the great social evil is to be grappled with and subdued—the base

of her society must be improved—the people must have the opportunity of health and of morality, that they may be both good Christians and loyal citizens!

DISCUSSION.

Dr. Ellis said that he had had extensive opportunities of observing the condition of the lower classes with respect to their dwellings, and could bear his testimony that the picture drawn by Mr. Rawlinson was by no means over-coloured, and he thought much general deterioration of health might be traced to the neglected condition of the poor. He entirely concurred in the remark of Mr. Rawlinson, that whilst on the one hand they could not but admire the benevolence, and charity, and zeal of those who went amongst the poor for the purpose of mitigating their sufferings and elevating their morals; yet, on the other hand, the endeavours to purify and correct were begun at the wrong end. He thought that the legislature ought not to be called upon to interfere in matters which the public generally could do for themselves, apart from all legislative enactments, which, in his opinion, would, after all, be ineffectual in providing a remedy for the evils complained of. He believed the extensive publication of the paper they had heard that evening throughout the towns and hamlets of the country, which so graphically and truthfully described the social condition of the great masses of the poorer classes, would have more effect in remedying the existing state of things than any legislative measures. The landlords had laid themselves open to severe reflections, though he was happy to say there were many honourable exceptions, foremost amongst whom might be mentioned the Duke of Bedford, on whose estates the cottages for the poor were models worthy of imitation. He was quite of opinion with Mr. Rawlinson, that it was from the want of information on these matters, rather than from any indisposition to effect the improvements which were so loudly called for, that the present state of things existed. He should like to see the subject ventilated by lectures given throughout the country, and no better picture of the existing evils could be drawn than that which had been so truthfully exhibited before them that evening. He was a decided advocate for lectures, by means of which he thought the public ear was most readily gained. Their endeavours ought to be directed towards the improvement of the health and morals of the poorer classes, by promoting a simple adherence to the laws of nature. By these means they would preserve in health those who were not already diseased, and restore those who were already afflicted with disease. He therefore said, let the people be instructed as to the value of cleanly dwellings, for there was no doubt that decent homes might be provided at no greater cost than was now expended for places which were not worthy of the designation of dwellings.

Mr. Edwin Chadwick, C.B., said that it might have been desired that practical details of measures of amendment should have been entered into, and there were few more capable of dealing with them than Mr. Rawlinson, but the necessary statement of the chief existing evils more than sufficed for one night's discussion. The statement of the evils should, however, be always accompanied by the encouraging fact, that in various instances, not only in London, but in other capitals in Europe, the promise of amendment had been fully realised in model dwellings, extremely rude and imperfect in construction as he believed they generally were. The death rates in them had, however, been kept steadily down to 13 in a thousand, the death rates attached to the dwellings of the poor being about 30 in a thousand, and in the general population of the metropolis about 23 in a thousand. The promise of amendment had been realised by the enforcement of his Lordship's Act for the regulation of common lodging houses, under which typhus had been almost banished from places known as fever nests, now superior in condition to immense masses of tenements occupied by workmen earning the highest wages. That measure, which had been exclaimed against as an undue interference, was only an application of the principles of the common law, under which owners had once been made amenable for letting tenements so constructed or so occupied as to create disease and to be dangerous in times of plague. In respect to the cost of amendment, the partially improved tenements were, when examined, by no means so unpromising as might at first appear. One of the earliest instances was a block of bulidings erected at St. Pancras, by the Metropoliton Society for the Improvement of the Dwellings of the Labouring Classes. The return upon that particular block, occupied by more than 500 persons, was, with all the extra expenses of company's management, about 4½ per cent. But on looking at the details of construction, with competent professional aid, he was warranted in alleging, that by the reduction of unnecessary materials used for no sanitary purpose, as good sanitary results might be obtained by an outlay of at least one-third less, giving a return of seven per cent. or more. It was a main fact, which should not be omitted in the statement of this question, that tenements of the very worst description produced the highest return upon the actual or necessary outlay of capital. At one period, when he enquired into the subject, he found that the general return upon house property was, for houses of the highest class, about 6 per cent.; for houses of the lower portion of the middle classes, from 7 to 8 per cent.; and for tenements occupied by the labouring classes, 12 per cent., or more, on the average, and not unfrequently as high as 16 per cent. But this excess of return for the worst description of property was generally absorbed by the expense of the weekly collection of rents, by their uncertainty, from changes of tenants, from sickness, and otherwise; and the greater part of the disablement from sickness, as well as the perpetual changes and fluctuations of the tenancy, were occasioned by the bad sanitary construction. He believed that by the application of capital on a large scale, much structural improvement might be effected, without increase of cost, and often with considerable economy; for many tenements, though cheap to construct, would be found practically dear to the tenant and the public, on account of the rates. The structural improvements desirable might, he thought, be dealt with in detail by the Society. There were the wall question, the grate question, and the chimney question, and there might be a window and a roof question, in addition to the ventilation question. There were wanted a non-absorbent brick, a brick that absorbed, at all events, less than a pint of water, and a wall that was not a prolonged sponge, occasioning damp, and requiring an excessive quantity of fuel to keep it dry; there were still required a more economical fire-place, which should give out as much heat with one-half the quantity of fuel at present used, and a chimney as well as a grate which did not discharge five-sixths or six-sevenths of the caloric unapplied; there was wanted a window for the lower class of houses, which did not, as windows made with the very thin glass now used did, discharge by radiation about one-third of the warmth of a room, the product of combustion, so that if a poor man paid a shilling a week for the warming of his apartment, fourpence worth of the product of combustion was wasted by the inferior windows. He thought these might form important topics for the consideration of the Society.

Mr. James Caird, M.P., could have wished, with Mr. Chadwick, that the paper had been of a more practical character. He had attended in the hope of listening to details of practical building to be applied to the dwellings of the poor, and had hoped to receive some instruction as to how the evils complained of might be obviated. He believed the whole country would approve of the principles laid down by Mr. Rawlinson, and was fully

alive to the importance of the subject. He therefore thought that their time would have been more profitably occupied in discussing the practical details of the question than in the laying down of principles to which he thought there could not but be universal assent.

Mr. THOS. SCOTT was so strongly impressed with the belief that the right course had been taken by Mr. Rawlinson in treating this important subject, that he could not agree with the remarks of the last speaker with regard to the discussion of the practical details. They all knew that the President of the Society had set the good example of building model cottages for labourers, and yet they had been condemned by many architects. At the same time His Royal Highness had done much good by enunciating the principle that better dwellings for the poor were required. In like manner Mr. Rawlinson had shown the necessity of cultivating a proper sense of the importance of this subject amongst those who have the means of providing better accommodation in the dwellings of the working classes. It was not always the case that the appearance of sanitary commissioners in a town tended to increase the value of property. He had known instances in which property had been greatly depreciated by that means, though he was ready to admit that in large towns the necessity of municipal or parochial interference in these matters was often evident. Mr. Scott proceeded to argue in favour of the promulgation of correct views in these matters, and of thus stimulating a desire for improvement amongst the people themselves. He instanced cases in Ireland and Scotland, illustrating the difficulty there was in overcoming long-rooted prejudices in favour of the cabin and the hut. It required the promulgation of principles to dispel those prejudices, and to raise the taste of a people to a true appreciation of the improvements which were designed for their benefit.

Mr. T. D. ACLAND regarded this subject as one of the greatest importance, and he believed he was not singular in that view. No doubt, amongst landlords there were to be found many selfish men, and the more they were denounced the better; although, perhaps, after all, that was not the best way of improving them. This subject had engaged the public mind for a great many years, and he was happy to say there were many good men earnest in the cause, but what they wanted to know was how to adapt the necessary improvements to the houses of the poorer classes, without being charged 20 per cent. more by the builder for carrying them into execution. He had lately been building on his own account, and though he had given most positive instrutions that the best known method of ventilation should be adopted, the builder had stated that he was unable to find any really practical system which he could adopt. It was known to many present, that the late Mr. Pusey, who was connected with the Royal Agricultural Society, had for sixteen years been constantly occupied with the subject of improving the dwellings of the labouring classes, and year after year had offered prizes for improved designs for cottages. It was universally admitted that good cottages should be provided for the people. They were told by the highest authority that if the poor man needed a cloak they should give it him; but he thought the practical question was the discovery of such means as would enable builders to construct such houses as should, at the current rate of wages for labour, enable the occupier to pay a remunerative rent to the builder for his outlay. He was equally surprised and gratified at hearing a few days since from Mr. Robert Smith, well-known in the agricultural world, that he had erected, in the district of Exmoor, six cottages, with three bed-rooms and a fire place upstairs, at a cost of only £60 apiece. That was a fact of great importance, and he hoped ere long Mr. Smith would give the world the benefit of his experience in this matter. For his own part he had always found difficulty in erecting cottages for £100 each. He hoped that Mr. Rawlinson, who was so well-qualified for the task, would, on a future occasion, point out some practical means by which this desirable object could be attained, namely, the erection of good and wholesome houses for the poor at a moderate cost.

Dr. WYLD advocated the plan of making iron bedsteads fixtures in a house, in the same way as was now done with fire grates. He thought if in one particular the poorer classes were more miserable and wretched than another it was in their sleeping accommodation. As a means of circulating statements of principles, and diffusing information on this subject generally throughout the country, he thought an excellent plan would be, that the numerous applicants at the hospitals should each receive a tract containing information upon this matter, and pointing out the conditions that were necessary for the enjoyment of good health. By that means interest would be excited on the subject amongst the masses, and much good would thus be effected.

Mr. G. F. WILSON, F.R.S., said in the suburbs of London with which he was most acquainted, namely, Vauxhall and Battersea, the rents of ill-built, ill-arranged cottages, were from 6s. to 7s. 6d. per week. He thought architects and builders present would say that gave a sufficient interest for money for erecting well-built houses with five rooms well ventilated. The difficulty as to the collection of rents might, he thought, be overcome in localities where there were large manufactories, by an arrangement being entered into between the builder of the houses and the employers of the men, for stopping the rent out of their weekly wages. He felt quite sure the working classes would appreciate good dwellings at fair rents.

Dr. WALLER LEWIS congratulated the meeting on being presided over by so practical a philanthropist as the noble lord in the chair, who had done so much, both in his public and private capacity, for the improvement of the dwellings of the poor. There was one point with reference to ventilation of rooms which was more a chemical than a mechanical fact, and which was generally overlooked. It was thought by architects and gentlemen not very much accustomed to chemical analysis, that the whole mischief of the want of proper ventilation was owing to the loss of oxygen from the atmosphere, and the substitution in its place of carbonic acid gas. That was by no means the case. A series of carefully conducted experiments had been made by a French physiologist of eminence on this subject. He confined some birds in a close box, absorbing, by means of chloride of calcium, the carbonic acid, as rapidly as it was formed, while he supplied fresh oxygen as it was required, so as to keep the atmosphere in its proper chemical condition. Notwithstanding, the birds died rapidly, showing that the mischief arose from the animal exhalations which destroyed life. It was the same with human beings confined in close atmospheres. One thing specially, it was well known, tended to the overcrowding of houses, and that was the improvements carried on in large towns, which necessarily, by destroying the smaller houses, drove the working classes away from their former habitations. As medical officer of one of the largest Government departments, the Post Office, he had had opportunities of seeing the effect of that system. He had just completed a series of calculations, based upon inquiries relative to the domiciliary condition of the 2,000 persons employed in the Post office, and he found that of that number 513 were obliged to live at a distance from their work of 1 mile and upwards; 358 at a distance of 2 miles and upwards; 104 at a distance of 3 miles and upwards; and 47 at a distance of 4 miles and upwards; whilst some few lived at a distance of 6 miles and upwards. They were not only banished to a long distance from their work, but they had to exert themselves by walking double that distance, and if they had to appear at the office twice in the day, even four times that distance. It was also to be remarked that the

employés of the Post-office had to pay a large proportion of their salaries for bad accommodation in the way of habitations. He found there were living in single rooms, 17, with 4 in family; 8 with 5 in family; and 4 with 6 in family. There were living in 2 small rooms, 30 with 5 in family; 18 with 6 in family; 8 with 7 in family; 5 with 8 in family; 3 with 9 in family; 1 with 10 in family; and 1 with 11 in family. The amount of rent paid by these men was, on an average, as follows:—Married letter carriers, 5s. 2d. per week, or 20 per cent. of their salaries; single letter carriers, 3s. 7d. or 12 per cent.; married messengers, 6s. or 20 per cent.; single messengers, 4s. or 13 per cent.; married sorters, 6s. 6d. or 25 per cent.; single sorters, 4s. 6d. or 16 per cent. of their salaries. Unmarried men paid for single rooms from 2s. to 5s. 6d. per week, being an average of 3s. 4d.; and one now even paid 4s. for half a room. Many of these poor men stated that their lodgings were healthy, but the fact was they had no conception of what real health was. He might add that during the prevalence of the epidemic at Newcastle, which had been referred to in the paper, some of the houses he had visited were so intensely unhealthy that he could not stay in the room for many minutes at a time, and yet the poor creatures living in them believed that the air was in a perfectly natural state. He agreed that some practical means of teaching people the difference between a good and bad sanitary condition, between a pure and a vitiated atmosphere, would be most valuable.

Mr. Palmer mentioned instances within his own experience of the advantages, in a commercial point of view, resulting from the improvement of existing dwellings. The health and comfort of the inhabitants were promoted, and they cheerfully paid the small addition to the rent which was necessary to compensate for the outlay in effecting these improvements.

Mr. Tottie gave some particulars, in addition to those mentioned by Mr. Chadwick, relative to the block of buildings in St. Pancras. At present they had from 16 to 20 vacancies in the premises, which he attributed to an excess of building in that locality, inasmuch as out of 449 houses erected since the establishment of those premises, 79 had bills in their windows. The fact was, the supply of houses in the neighbourhood was at the present time greater than the demand.

Mr. J. A. Rose felt convinced that this discussion would do good to all classes. The landlord learnt that by improving existing houses he might get sixpence a week more rent from his tenant, and he apprehended that after all it was only by the consideration of the question commercially, that any large measures for alleviating the condition of the working classes, in respect of their dwellings, were likely to be promoted; for in looking at this subject, they must take human nature as it actually was, and not as they could wish it to be. Then, again, the statement being put forth that cottages might be built for £60 each, would probably have, in some cases, this effect—that as rents were so much lower, the workman could do with less wages. Much as had been said about ventilation, he thought they had a good deal to learn before they arrived at a really practical plan. Mr. Rose added some remarks in advocacy of affording proper accommodation for the sleeping of domestic servants—a class which he feared was generally much neglected in this respect.

The Chairman, in proposing a vote of thanks to Mr. Rawlinson for his able paper, remarked that he could speak with perfect confidence as to the merits of that gentleman, because it had been his pleasure to be associated with him for many years in works of this description. During the time that he (the Chairman) had the honour of holding a seat at the Board of Health, Mr. Rawlinson was one of their agents, and for diligence and activity, knowledge and zeal—not merely professional zeal, but influenced by deeply moral and humane feelings—he was unsurpassed. They were all acquainted with the valuable services he had rendered to the country as the Government civil engineer at Scutari and the Crimea; and he (the Chairman) was glad to find that he had returned fresh and vigorous, determined to devote his great energies to the improvement of the condition of the human race in his own country. He believed the announcement that the paper to be read was upon the social and national influence of the domiciliary condition of the people, had attracted a great many to this meeting, especially the ladies, and he could not but feel that, in his opinion, the paper was in strict keeping with its title. He was convinced that the domiciliary condition of the people was at the root of all moral and religious improvement. It was astounding to observe what effects good dwellings, with plenty of air and sunshine, had upon the morals of a community; they tended more than anything else to combat that monster evil—the vice of intemperance. He, therefore, thought the proper way to enter upon the discussion of this question was to begin with a statement of principles. He agreed with Mr. Chadwick, that in contemplating existing evils they ought not lose sight of the good that had been effected in this direction, in many of our large towns and in various quarters throughout the country, but the good that had been already effected only imposed upon them the duty of making still greater exertions to carry it on to its utmost limits. With regard to the erection of new dwellings for the working classes upon the best sanitary conditions in densely populated towns, where the priee of land, labour, and materials was very high, he felt there was but small chance of doing so with a remunerative profit. They could not look for more than 6 or 6½ per cent., which the builder did not regard as a sufficient return for his capital. But, as had been stated this evening, very much might be done in improving existing buildings and localities, so as to render them fit for habitation, and this would, as almost every instance had proved, be attended with a remunerative return to those by whom the improvement was effected. The Chairman then proceeded to explain the improvements which had been carried out in the localities of Wyld-court and Tyndals-buildings, and mentioned the beneficial results that had accrued therefrom, in the elevation of the moral and social condition of the inhabitants. In the country there was a very great difference in this respect; the cost of land, which formed the principal item in large towns, being so much less, and labour and materials cheaper. Still he had found that he could not build a pair of cottages for less than £280, and a high rent must be paid in order to afford a fair interest for that outlay. What they required, therefore, was a cheaper but not less efficient mode of building cottages, with not less than three bedrooms, which he held to be indispensable for every family. Ventilation was a matter of the utmost importance, but the poor were found to prefer warmth to pure air so strongly, that he had in some instances resorted to the stratagem of introducing a concealed ventilator in order to render their dwellings healthy. In carrying out improvements it was necessary that the tenants should peremptorily be prohibited from taking lodgers, or the existing evils would be increased. In conclusion his lordship said he felt the deep importance of the question under discussion, which he thought lay at the root of all that concerned the religious and moral state of the people, and he was certain that if they would use every effort to raise the poor to that condition which they ought to occupy as Christians and responsible beings, he, for his part, should have no fear either of the progress of infidelity or of democracy.

A vote of thanks was then passed to Mr. Rawlinson.

On the table were exhibited specimens illustrating the decay of Gutta Percha, as described

in Mr. Highton's report. (See "Decay of Gutta Percha," given below.)

The Secretary announced that on Wednesday evening next, the 10th inst., a paper by Mr. J. Algernon Clarke, "On the Application of Steam Power to the Cultivation of the Soil," would be read.

DECAY OF GUTTA PERCHA.

The following report of Mr. E. Highton, to the Directors of the British Telegraph Company, is the result of further experiments made by that gentleman. It will be recollected that the results of his former investigations were given in the last volume of the *Journal*.*

"*To the Directors of the British Telegraph Company.*

"GENTLEMEN,—I beg to hand you several specimens of gutta percha-covered wire, and also sheet gutta percha, which have been experimentally subjected to the action of the mycellium of a fungus, viz., the *Agaricus Campestris.*

"The gutta percha was placed in different parts of a bed of soil, 5ft. 6in. wide by 5ft. 3in. long. The spawn of the fungus was placed in the soil, at intervals, over that space, in the month of September, 1857.

"The mycellium traversed the whole of the bed.

"The gutta percha sent has not been touched by the hand or a tool until exhumed on the 25th of January, 1858.

"The several specimens sent will show the complete destruction of gutta percha by the mycellium of a fungus, and prove, I trust, the correctness of the opinion I expressed many months ago.

"Should the Company desire any further experiments, I shall be happy to make them; but I consider those already made by me so conclusive as to render further experiments in the same line unnecessary.

"I am, gentlemen, your obedient servant,

"EDWARD HIGHTON.

"London, January 28th, 1858."

The specimens referred to may be seen at the House of the Society of Arts.

SOUTH KENSINGTON MUSEUM.

The weekly course of lectures addressed to the working classes, explanatory of the collection of animal products, has been successful, attracting full audiences in the lecture theatre. Three lectures have already been delivered. The first, a general introductory one, on "The Animal Kingdom and its Economic Uses," was given on the 18th ult., by Professor Owen, F.R.S., Superintendent of the Natural History Department of the British Museum. The second, on the 25th ult., on "The Use of Refuse Animal Matter," by Dr. Lyon Playfair, C.B., F.R.S., Chief Inspector of Science Schools. The third, on "Shells and their Economic Uses," was given on Monday evening, the 1st inst., by P. L. Simmonds, Esq., of the Museum, in the absence of Dr. J. E. Gray, F.R.S., who was prevented by illness from attending. The lecture was illustrated by specimens from the Museum and Mr. Simmonds' private collection. Frank Buckland, Esq., Surgeon to the 2nd Life Guards, will deliver the next lecture, on Monday evening, the 8th inst., "On Horn, Hair, and Bristles."

During the week ending 30th January, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,460; on Monday, and Tuesday, (free evenings), 2,247. On the three students' days (admission to the public 6d.), 630. One students' evening, Wednesday, 243. Total, 5,580.

* See Vol. V., pp. 264 and 486.

SMOKE NUISANCE.

The following is the report of Mr. Cashin, the Corporation Consulting Inspector in Sheffield:—

GENTLEMEN,—Pursuant to your instructions, I beg to report that during the past year, in all cases in which you have directed a summons to issue for a breach of the smoke bye-laws, the full penalty has been inflicted, save in some exceptional cases, in which—looking at the fact that you desire not the imposition of fines, but compliance with the law—valid explanations were offered, and I did not feel at liberty to oppose an application for time to make alterations. In one case, however, that of Mr. W. H. Brown, of Harvest-lane, it was held that rolling-mill furnaces, even when connected with an engine chimney, were exempt from the operation of the law.

Progress has been made in the suppression of the smoke nuisance, but much has yet to be done to secure its permanent abatement. Inspector Wood's reports show that during the years 1855 and 1856 he had to record a discharge of smoke varying from 20 to 35 minutes in the hour from nearly all the chimneys of which he took observations—such cases are now the exceptions.

The bye-laws have not been harshly or rigorously applied; on the contrary, every effort has been made to carry them out in the most conciliatory spirit, and to make them as little irksome as possible to the class whom they affect. The committee have demanded not the absolute consumption of smoke, but so much as has been proved to be practicable; and in proper cases where efficient means had been provided for the accomplishment of this object, the engine-tenters have been proceeded against for negligence.

Many experiments, entailing serious expense and resulting in failure, have been tried; and much money has been spent in applying plans importunately forced upon attention which have been utterly useless. For such results it is sometimes urged that the committee are responsible, as they do not undertake to prescribe some particular plan. Apart from the objection that the employment or adequate payment of a competent person to direct the application of such plan would be opposed to public feeling, it is obvious that no one plan can meet varied requirements. Adaptation to meet the peculiar circumstances of each case is needed; and were the committee to exact the removal of the radical defects which exist in numerous instances, and which preclude the application of an effective plan, such mode of procedure would be more loudly objected to than the present. But, independently of this, it is clearly the duty of steam-engine proprietors, either by combined action or individually, to obtain efficient advice at their own expense and not at the expense of the ratepayers.

Another objection pertinaciously urged is, that the gases resulting from perfect combustion are more injurious to health than smoke. It is true that carbonic acid gas is injurious to animal life, but, under the circumstances, the objection does not apply. Carbonic acid in its natural state is specifically heavier than air, but as the result of combustion it issues from the chimney, not at the ordinary temperature of the air, but expanded by heat to more than double its ordinary bulk; it is then specifically lighter than the atmosphere in which it ascends and becomes diffused. No analogy obtains between this gas and a noxious mechanical mixture such as smoke. An excess of carbonic acid cannot exist in the atmosphere, the relative proportions of the constituent gases of which are constant, derangements arising from surface and low level exhalations being merely local and temporary.

The prevention of smoke has for some time occupied the attention of scientific men, and no fact is better ascertained than that smoke is the result of a defective mode of supplying air to the crude gas evolved from the coal. The nuisance is produced by the carbonaceous mixture which passes off with this gas when the coals are clumsily burnt, without proper arrangements for the admission of air. To regulate the due admission of air, is the object generally proposed to be accomplished.

The present construction of furnaces and mode of applying heat demands a large continuous supply of atmospheric air, varying with the rate of combustion and the quantity and quality of the fuel.

If too much air be admitted into the furnace it absorbs heat, chills the flues, and reduces the temperature below the combustion point, causing smoke and a great waste of fuel. If an insufficient quantity be supplied, the hydro-carbonates—the constituents of coal gas—pass off with a large proportion of carbon in minute particles unconsumed. These carry with them not only the large quantity of heat which they are capable of giving out on combustion, but the heat expended in their elimination from the coal.

But so rude and imperfect is the present mode of construction, that with the best appliances and mechanical arrangements to assist the natural affinities and combination of the gases, more than double the quantity of air absolutely necessary for combustion passes through the furnace, carrying with it the heat which it absorbs. In an ordinary furnace it is found in practice that about 300,000 cubic feet, or eleven tons, of air pass through for every ton of coals consumed!

This materially affects the available heating power of the coal, which is further limited by the rate of combustion. With rapid combustion there is necessarily a sacrifice of fuel; more heat is generated in a given time, and consequently more water evaporated, but a large proportion of the heat is carried away by the increased temperature of the escaping products. With slow combustion more time is afforded for the heat to be taken up, and consequently more is utilized.

In all cases, however, a large amount of heat passes away through the chimney.

To remedy this primary defect in the existing system, an invention has been patented by Mr. Siemens, of London, which is applicable to nearly every description of heating furnace.

Mr. Siemens proposes to utilize the heat generated, and obtain therefrom the full equivalent of effect by using a regenerative furnace, in which he passes the air required for combustion through a regenerator, and the products of combustion—before they reach the chimney—through another regenerator, which consists of a chamber filled with fragments of refractory materials or firebricks, presenting a large amount of absorbent surface, to which the heat is communicated; the bricks or other substances nearest the fire become heated to a high degree of temperature; those next to them become heated to a less degree; and those at the other extremity comparatively little—the temperature gradually decreasing towards the outlet. Were this process to continue, the whole regenerator would attain the same heat as the escaping gases, which would then pass into the chimney as hot as when they entered the regenerator, and no good would result; but by a beautifully simple arrangement the inlet for the air and the outlet to the chimney are so connected with both regenerators (which are constructed of the same materials) that by changing a valve the current is reversed; the air passes through the heated regenerator and attains a high temperature before it reaches the fire, and the products of combustion pass through the regenerator, through which the air had previously passed in a contrary direction. When this regenerator becomes charged with heat, the valve is again reversed, and the alternate action continued.

By these means, with a minimum draught, intimate mechanical contact and consequent chemical union of the gases are established, and the heat generated is retained in the furnace—the products of combustion escaping at a temperature not exceeding 200° or 300° Fahrenheit.

Rolling-mill furnaces, constructed on this principle, have been in use at Messrs. Marriott and Atkinson's for some months; and in reference to them, Mr. Atkinson, at a meeting of the Institution of Mechanical Engineers, in June, 1857, stated that he "had a particular account kept of the coals consumed by a furnace on Mr. Siemen's plan and one of the ordinary construction, and he found the total consumption of each, during six days, was 7 tons in the ordinary furnace, and 1½ tons in the new one, the work done by each being practically the same, and all circumstances alike during the time of comparison."

Mr. Brown, of the Atlas works, has also had two furnaces erected on the same principle; they are of a large size, for heating bar-steel, and on submitting them to a trial the following results were obtained:—

Furnaces.	Time worked.	Weight of Steel heated.	Coals consumed.	Consumption of coals per cwt. of Steel.
Old	10 hours.	145 cwts.	30 cwts.	23 lbs.
New	10 ,,	121 ,,	10 ,,	9¼ ,,*
Old	6 days.	77 tons.	26½ tons.	38½ ,,
New	2 hours.	48 ingots.†	2 cwts.	6¼ ,,

* 60 per cent. less than the old. † 86lbs. each (about 37 cwt.)

The invention is most valuable where the most intense heat is required; and the result of experiments shows that it may be applied to steel-melting furnaces. In melting steel by the present process, of the heat produced little more than 1 per cent. is made available. On investigating the operation of melting and the calorific effect of coke, I find that the heat given out by the coke in combustion melts only 1-70 of the quantity of steel it is capable of melting if wholly utilized, thus showing that 98·5 per cent. of the heat generated is wasted!

It is proposed to apply the principle to engine furnaces; and on the completion of the experiments I will communicate to you the results.

From the furnaces erected at Mr. Atkinson's and Mr. Brown's no opaque smoke escapes. I append a report of observations made on these and other rolling-mill furnaces by Inspector Wood. The ordinary principle of consuming smoke is not applicable to rolling-mill furnaces, nor do the bye-laws affect them; but when it is considered than an Act of Parliament has been passed relating to the general prevention of smoke in Scotland, and that an act is now in operation in London from the provisions of which no description of furnace is exempt, it seems more than probable that the Smoke Act will be extended to the whole country. It is more economical to anticipate the provisions of such an Act when a convenient opportunity offers, than to comply with them under pressure. In submitting these facts for consideration, I trust I am not departing from my proper province: my desire is simply to afford information that might otherwise possibly escape attention.

I have the honour to be, gentlemen,
Your most obedient servant,
T. F. CASHIN.

16, Bank-street, Sheffield, 6th Jan., 1858.

WORKING MEN'S LIBRARIES.

The Society for the Diffusion of Pure Literature among the People, which is under the presidency of the Earl of Shaftesbury, has issued a notice, stating that by the liberality of one of their number, the committee are

enabled to offer, at half-price, libraries of £5 worth and upwards of books for Working Men's Institutions, and similar bodies with a responsible committee or trustees, on the recommendation of a subscriber. The books must be selected from a catalogue issued by the Society. Any person applying for a library should describe the purpose for which it is wanted; and if the grant is passed by the committee they will forward a catalogue to be marked and returned by the applicant (together with the half price of the value of the library), when the books will be sent immediately. Applications should be made to the secretary, at the office of the Society, 9, John-street, Adelphi, W.C., where may be seen copies of most of the books in the catalogue.

Home Correspondence.

THE "ACCUMULATOR."

SIR,—My attention has been called to the following paragraph, forming part of the Chairman's observations at the meeting of the Society on Jan. 13th:—

"The water which was thus being constantly—day and night—stored up in this magazine of power, remained there subject to the enormous pressure which had been gradually overcome; it was accumulated as a store, to be used in three, four, six, or ten hours, as the case might be, and the apparatus, which was the patented invention of Mr. W. G. Armstrong, of Newcastle, was called an accumulator. He could speak most strongly as to the simplicity and value of this arrangement, by which it was obvious that wherever circumstances were favourable for the collection of streams at an elevation of even a few feet, the hitherto neglected power of such streams might be made available to a much greater extent than they could possibly have been under the system of water wheels alone."

I believe the accumulator has not been patented by Mr. Armstrong, but it will be found in a patent taken out by me in 1851.

I have reason to think, however, that a similar idea occurred to Mr. Armstrong about this time.

I am, &c.,
MICHAEL SCOTT.

26, Great George-street, Westminster, 1st Feb.

LORD PALMERSTON'S MORTAR.

SIR,—With all deference to the high authority of Mr. W. Hawksworth, I venture to point out some few inaccuracies in that gentleman's observations, inserted in your *Journal*, January 29th, upon my proposed steel-bored ordnance.

Mr. Hawksworth says that "the welding of such a mass of steel is open to serious objection." In the manufacture of ordinary gun barrels, the operation of welding the spiral, technically called "jumping," is extremely simple, and as the steel bar is intended to be rolled up on a mandril, in an absolutely close coil with clean faces, by means of a modification of the three cylinder rolls, one "jump" would weld the whole of that part of the coil that had been sufficiently heated, and no injury whatever could take place. Mr. Hawksworth goes on to say that "the cast metal jacket would most assuredly destroy the internal core by crystallisation." Large quantities of chilled cast-iron are used for a variety of purposes, and I never yet saw the iron mould affected by the heat of the melted metal. In the case of my proposed steel bore, it would be impossible to over-heat a mass of steel 18 inches in diameter, 4 inches thick in substance, and 12 feet long, with the addition of a cold iron mandril, fitting the bore, 10 inches in diameter, and two or three feet longer than the steel coil.

Mr. Hawksworth also says that "the shrinkage of steel is greater than that of cast-iron." This may be the case to a very small extent, but when it is considered that the circumference of the cast-iron jacket, three feet in diameter, is double that of the core, and that the latter is at a low degree of heat, the shrinkage will be found to be greatly in favour of the powerful compression and intimate union of the outside jacket with the steel core.

In regard to Mr. Hawksworth's own experimental gun, the result might have been readily anticipated, as cast-steel is well-known to be quite as brittle as cast-iron, and the hammering on a mandril would render it still more fragile. Cast-steel can only be brought into a state of toughness, exceeding seven times the strength of cast-iron, by repeated drawing, and not by hammering alone, which although it hardens and condenses, renders the steel more brittle than before.

It is a mere blacksmith's prejudice that cold hammering can render iron or steel stronger than it is in its natural state. It does become harder to turn in the lathe and to file, but, at the same time, its tenacity is destroyed; as, indeed, one blow too much will send the work to shivers. The steel-bar intended to form my spiral bore, is supposed to be drawn into the state of the utmost tenacity it is capable of acquiring, and all cold hammering, that is, below a cherry-red heat, has been carefully avoided. I am, &c.,

HENRY W. REVELEY.

Poole, Jan. 31st, 1858.

To Correspondents.

ERRATA.—In the last number of the *Journal*, page 162, 1st col., line 56, for "Giult" read "Gwilt," and for "315" read "316." Col. 2, line 40, for "waste" read "water." Page 163, col. 2, line 13, for "752" read "52."

MEETINGS FOR THE ENSUING WEEK.

MON. Architects, 8.
Geographical, 8½. I. Journey from Little Namaqualand eastward along the Orange River, the Northern Frontier of the Colony, &c., with Map. By Mr. Robert Moffatt, F.R.G.S. II. Route by the Rivers Waini, Barama, and Cuyuni to the Gold Fields of Caratal, &c. By Sir W. H. Holmes and Mr. W. H. Campbell. III. Preparations for the Departure of the Livingstone Expedition.

TUES. Royal Inst., 3. Prof. Huxley, "On Animals and Plants considered Morphologically."
Syro-Egyptian, 7½. I. Mr. Charles E. Harle, "On the Cylinder of Tiglath Pileser, and notice of a slab lately brought from Hoymijik, illustrating some passages in the Book of Amos." II. Dr. Heinrich Jolowicz, "On Egyptian Mythology."
Civil Engineers, 8. Discussion upon Mr. J. Henderson's Paper, "On the Methods generally employed in Cornwall, in Dressing Tin and Copper Ores." And, if time permits, Mr. J. A. Longridge, M. Inst., C.E., and Mr. C. H. Brooks, "On Submerging Telegraphic Cables."
Med. and Chirurg., 8½.
Zoological, 9.

WED. Literary Fund, 3.
Society of Arts, 8. Mr. J. Algernon Clarke, "On the Application of Steam Power to the Cultivation of the Soil."
Graphic, 8.
Microscopical, 8. Anniversary.
Archæological Asso., 8½.

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Antiquaries, 8.
Royal, 8½.

FRI. Astronomical, 3. Anniversary.
Royal Inst., 8½. Prof. Faraday, "On Static Induction."

SAT. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Jan.* 29, 1858.]

Dated 21*st December*, 1857.

3127. William Thrift and Adam High, Stepney—An improved self-acting ship's water closet.

Dated 28*th December*, 1857.

3174. Henry Desmoutis, Paris—New metallic alloys.

Dated 7*th January*, 1858.

28. Eliza Graham, 14, Noel-street, River-terrace, Islington—An improved apparatus for threading needles.

Dated 11*th January*, 1858.

43. William Tregaskis, 37, St. Andrew's-hill, Thames-street—Improvements in the printing press.
45. Isaac Taylor, Stanford Rivers, Essex—Improvements in manufacturing metallic cylinders used in printing calico and other fabrics, and in imparting engravings to metallic cylinders used for such purposes.

Dated 12*th January*, 1858.

47. Edward Hammond Bentall, Heybridge, near Maldon, Essex—An improved arrangement of portable gearing apparatus for the application of horse power, principally for driving various kinds of agricultural machines or implements.
49. John Henry Johnson, 47, Lincoln's-inn Fields—Improvements in boilers and heating apparatus generally. (A communication.)

Dated 13*th January*, 1858.

51. Charles Barlow, 89, Chancery-lane—An improved registering water meter. (A communication.)
53. Richard Archibald Brooman, 166, Fleet-street—Improvements in the preparation of coal and other fuel. (A communication.)
55. Patrick Robertson, 1, Sun-court, Cornhill—Improvements in inkstands. (A communication.)
57. Charles Edward Matson, Charles-street, Deptford—Improvements in roughing horses' shoes.

Dated 14*th January*, 1858.

59. Nicolas Eugène Jeanroy, Rue de l'Echiquier, Paris—Improvements in the manufacture of net lace.
60. William Woodcock and Thomas Blackburn, Sough, near Blackburn, and James Smalley, Blackburn—Improvements in machinery or apparatus for heating and circulating air, to be applied to all purposes where heating is required.
61. James Alexander Manning, Inner Temple, Middlesex—Improvements in the treatment of sewerage and other polluted liquids.
62. James Broadley, Saltaire, near Bradford—Improvements in apparatus used in weaving.
63. Joseph Stenson, Northampton—Improvements in the manufacture of wrought iron.
64. Henry Ingle, Shoe-lane—Improvements in printing machines.
65. William Clark, 53, Chancery-lane—Certain improvements applicable to the paying out of submarine or submerged telegraph wires or cables. (A communication.)

Dated 15*th January*, 1858.

66. John Varley, Albion Iron Works, Radcliffe—Improvements in steam engines.
67. Charles Schinz, Camden, New Jersey, U.S.—An apparatus for manufacturing prussiate of potash.
69. David Bowlas, Reddish, Lancashire—Improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

Dated 16*th January*, 1858.

71. Richard John Badge, Newton Heath, near Manchester—Improvements in machinery or apparatus for drawing or extracting spikes or trenails from railway sleepers and chairs, and other similar purposes.
72. James Austin, Millisle Mills, Donaghadee, Ireland—Improvements in machinery or apparatus for ploughing or cultivating land.
73. Robert Archibald, Devon-vale, Tillicoultry, N.B.—Improvements in the treatment or preparation of wool, and other fibrous materials for being spun.
74. George Macbeth, Manchester—A certain improvement applicable to sewing machines.
75. Frederick Hyde, Glossop—Improvements in machinery or apparatus for spinning, doubling, twisting, or throwing cotton, silk, wool, flax, and other fibrous substances.
76. Edwin Hills, Warsash, Southampton—An improved process for manufacturing sulphate of ammonia.
77. Patrick Robertson, Sun-court, Cornhill—Improvements in lamps. (A communication.)
78. Charles Amedée de Laire de la Brosse, Paris—Improvements in apparatus or machinery for the manufacture of looped or knitted fabrics. (A communication.)
79. Edward Rosa, Edinburgh, N.B.—Improvements in the manufacture of dough and other plastic or porous substances.

Dated 19*th January*, 1858.

81. Thomas Hamilton and James Hamilton, Glasgow—Improvements in holders or bobbins for holding or containing yarn or thread, and in turning, cutting, shaping, and reducing wood and other substances.
82. Andrew Walker and Thomas Walker, Shotts, Lanark, N.B.—Improvements in the treatment or preparation of moulds for casting metals.
83. Edward Wilson, 9, Rainbow-terrace, Worcester—Improvements in pistons for steam engines driven by steam or any other elastic fluid, which improvements are also applicable to the pistons or plungers of pumps.
84. William Waller, Uddingston, near Glasgow—Improvements in machinery for grinding, bruising, breaking, and cutting cereals, grasses, and other vegetable substances.
85. William Waller, Uddingston, near Glasgow—Improvements in thrashing machines, or machinery for thrashing and dressing grain.
87. Peter Schuyler Bruff, Ipswich—Improvements in the construction of submerged tunnels.
88. Giuseppe Antonio Tremeschini, Vicenza, Venetian Lombardy—Improved methods and mechanical arrangements for applying card-board to the weaving of figured fabrics, and for arranging the card-board for this purpose.
89. Benjamin Blake Wells, Strand—Improvements in ordnance.
90. John Henry Johnson, 47, Lincoln's-inn Fields—Improvements in the boxes and journals of carriage wheels and axles, and in journals and bearings generally. (A communication.)
91. Thomas Pirie, Nether Kinmundy, Aberdeen, N.B.—Improvements in machinery or apparatus for thrashing or separating grain.
92. Philip Capon, Chancery-lane—Improvements in apparatus for binding together pamphlets, letters, music, and other loose documents or sheets.
93. Otto Von Corvin, Alfred-place, Alexander-square, Brompton—Improvements in the mode of inlaying or ornamenting in metals and other materials.

Dated 20*th January*, 1858.

94. Christopher Nugent Nixon, Ramsgate—Improvements in the application of screw power, such improvements being applicable to steering apparatus, capstans, windlasses, cranes, winches, and other mechanical purposes.
96. Thomas Heppleston, Manchester—Certain improvements in machinery or apparatus for winding yarns or threads.
100. Charles Rishworth, Sheffield—An improved construction of spring for sustaining loads and moderating concussion.
102. John James Russell, Wednesbury, Staffordshire—Improvements in apparatus used in the manufacture of welded tubes.
104. Patrick Robertson, 1, Sun-street, Cornhill—Improvements in the manufacture of paints. (A communication.)

WEEKLY LIST OF PATENTS SEALED.

January 29*th*.

2086. Thomas Markland.
2087. Henry Genhart.
2089. George Inman.
2098. William Hopkinson.
2100. Rd. Archibald Brooman.
2101. George Brooks Pettit and Henry Fly Smith.
2111. Charles Iles.
2118. Thomas Lyne.
2131. John Langford and Joseph Wilder.
2155. William Pratchitt and Samuel Horrocks.
2459. Alfred Vincent Newton.
2802. Charles Edwards Amos.

February 2*nd*.

3103. Robert Davison and James Lee.
2108. Alexander Prince.
2148. William Lyell Groundwater and Henry Prince.
2206. Robert Clark Gist.
2234. Perry G. Gardiner.
2262. Alfred Vincent Newton.
2280. Jules Alphonse Chartier.
2662. William Osborne.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

January 26*th*.

236. George Price.

January 27*th*.

237. James Howard.

January 28*th*.

234. Arthur Lyon.
1060. Edward Humphries and Thomas Humphries.

January 29*th*.

244. Thomas Ogden Dixon.
250. George Ritchie.

January 30*th*.

240. John Francis Porter.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4048	Jan. 29.	Invalid Bed Table	Armstrong Todd	Ardwick, near Manchester.
4049	Feb. 2.	Reflectors for Stereoscopes	Murray and Heath	43, Piccadilly.
4050	„ 2.	Improved Stud or Fastener	William Cooper	Birmingham.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 12, 1858.

DEPUTATION TO HIS ROYAL HIGHNESS THE PRESIDENT.

A deputation of Members of the Society of Arts, and of Presidents of the Institutions in Union, attended at Buckingham Palace on Thursday, the 11th inst., at 3 o'clock, to present a congratulatory address to His Royal Highness the Prince Consort, President of the Society, on the occasion of the marriage of Her Royal Highness the Princess Royal with His Royal Highness Prince Frederick William of Prussia.

The address, which was signed by upwards of ten thousand Members of the Society of Arts and of the Institutions in Union, was read by Mr. C. Wentworth Dilke, Chairman of the Council.

To His Royal Highness the Prince Consort, President of the Society for the Encouragement of Arts, Manufactures, and Commerce.

We, the undersigned Members of the Council, and Members of the Society for the Encouragement of Arts, Manufactures, and Commerce, and of the Institutions in union therewith, desire to present to your Royal Highness our heartiest congratulations upon the marriage of Her Royal Highness the Princess Royal with His Royal Highness Prince Frederick William of Prussia; and we sincerely hope that the fullest happiness will attend this union.

The long period of fourteen years, during which the Society of Arts has enjoyed the active Presidency of your Royal Highness, will, we trust, justify our seeking this opportunity to express our sense of the deep obligation which the Arts, Manufactures, and Commerce of the United Kingdom owe to your Royal Highness, for the constant and discriminating attention and the judicious acts by which you have promoted their progress.

We feel that the marriage of Her Royal Highness the Princess Royal with the Prince of a great Country so much like our own as Prussia, in the love of Arts, Science, and Industry, must tend to promote international friendship, and so extend and secure to both countries the peaceful and beneficent objects for the encouragement of which our Society is instituted.

These objects, we believe, form the soundest basis upon which the material interests of Nations can rest for advancing their political liberties, their commercial prosperity, and their social happiness.

The reply of His Royal Highness, the President, was as follows:—

I beg you to accept my warmest thanks for your kind congratulations on the marriage of my beloved eldest daughter with Prince Frederick William of Prussia.

This union, which, from the education and personal character of the young Prince, promises to secure the permanent happiness of our dear child, could not but fill the hearts of both the Queen and myself with joy, and with thankfulness to Almighty God; but we have derived additional satisfaction and pleasure from the universally expressed sympathy, and participation in our joy, by the nation at large.

That this sympathy should be re-echoed by your Society, which, during fourteen years has commanded my best wishes, and any feeble assistance which I could render to it, must be most gratifying to me.

Gentlemen, these fourteen years, which have seen my daughter grow up from an infant, to become a married wife, transferred to a high sphere of usefulness in a foreign land, to which our most tender affection must still follow her, have also seen children of yours,—I mean the many plans and schemes for the promotion of Art, Science, and Industry which you have originated,—develope themselves, and grow up into independent life and power. Some of these have attracted the admiration of the world, whilst you could only follow them from a distance, with the fond eye of a parent who finds his highest gratification in the success of his offspring.

I am glad to find you accompanied on this occasion by the Deputations of the many Institutions throughout the country with which you have placed yourselves in union, and to have this opportunity of expressing to them my strong sense of the usefulness of their exertions for the promotion of the Education of the Adult Classes in this country. I trust they will at all times freely bring the result of their varied experience to the knowledge of the Society, to which suggestions coming from them must naturally be most valuable.

The undermentioned gentlemen composed the deputation, and had the honour of being presented to His Royal Highness by the Chairman of the Council:—

E. Akroyd, M.P., President, Haley-hill Working Man's College.
J. D. Allcroft.
J. G. Appold, F.R.S., Auditor.
Chas. Atherton.
Dr. Herbert Barker, Hon. Local Secretary.
Rev. John Barlow.
J. A. Beaumont, President, Beaumont Philosophical Institution.
Booker Blakemore, M.P.
Charles Bleeck, Pres., Warminster Athenæum.
W. H. Bodkin.
W. P. Bodkin, Highgate Literary and Scientific Institution.
H. G. Bohn.
Beriah Botfield, M.P., F.R.S.
Antonio Brady.
John Braithwaite.
William Bride, Mayor of Yeovil, Pres., Mutual Improvement Society, Yeovil.
Captain Bulkeley, Pres., Literary and Scientific Institution, Windsor.
C. S. Butler, M.P.
W. Button, President, Lewes Mechanics' Institution.
James Caird, M.P.
Lord Carnarvon, President, Newbury Literary Inst.
F. S. Cary.
Edwin Chadwick, C.B.
William Challinor, President, Leek Literary Inst.
Dr. Chambers, Member of the Council.

R. L. Chance, President of the West Bromwich Inst.
Harry Chester, Vice-President.
Dr. Chowne.
John M. Clabon, President, Kingston-on-Thames Literary and Scientific Institution.
Rev. S. Clark.
John Clutton.
A. Claudet, F.R.S.
A. Coleman, President, Wandsworth Literary Inst.
W. Fothergill Cooke.
James Coombs, Pres. Bedford Lit. and Scientific Inst.
Dr. Copland.
Samuel Courtauld.
Thomas R. Crampton.
George Critchett.
H. D. P. Cunningham.
William Curtis, President, Alton Mechanics' Institution.
John Darlington, Hon. Local Sec.
J. C. Deane.
Warren de la Rue.
Thomas de la Rue, F.R.S.
Thomas Dickins.
John Dillon.
Henry Doulton.
M. H. Drury, Haley-hill Working Man's College, Halifax.
J. A. Dunn, Pres. London Tailors' Labour Agency Literary Institute.
Col. Eardly-Wilmot, R.A.
Lord Ebury.
Henry Edwards, President, Lynn Athenæum.
William Ellis.
William Fairbairn, F.R.S., Member of Council.
Dr. Farr.
R. T. Fauntleroy.
Joseph Fenn.
Robt. Fisher.
W. M. Fladgate.
Benjamin Fothergill.
John Fowler.
F. F. Fox, President, Melbourne (Derbyshire) Mechanics' Institution.
J. Griffith Frith, Member of Council.
T. H. Galton, President, Bromsgrove Literary and Scientific Institution.
Thomas Garfit, President, Boston Athenæum.
Richard Garrett, President, Leiston Mechanics' Institution.
J. P. Gassiot, V.P.R.S.
Thomas Field Gibson, F.G.S.
J. W. Gilbart, F.R.S., Member of Council.
William Gladstone, President, Highgate Literary and Scientific Institution.
Joseph Glynn, F.R.S., Vice-President.
F. Godrich, President, West Brompton Literary and Mutual Improvement Institution.
George Godwin, F.R.S.
Daniel Gooch, President, Great Western Railway Literary Society.
Peter Graham, Member of Council.
G. Greatorex, President Ashbourn Literary Institution.
Stephen Green.
Rev. C. Stroud Green, President, Lewes Impt. Asso.
Alfred Gyde, President Painswick Mechanics' Institution.
F. S. Haden.
S. C. Hall.
William Hamilton, R.N., President, Portsmouth and Portsea Literary and Philosophical Society.
Rev. J. H. Hamilton, President, Pimlico Literary, Scientific and Mechanics' Institution.
W. Parker Hammond, F.R.A.S.
Michael Hanhart.
G. W. Harris, President, Halstead Literary and Mechanics' Institution.
Charles Hart.
Rev. Henry Hawkes, President, Portsea Athenæum and Mechanics' Institute.
John Hawkshaw, F.R.S.
Henry Heane, President, Newport (Salop) Mechanics' Institution.
Rev. Lord Arthur Hervey, President, Bury St. Edmund's Athenæum.
Samuel Hickson.
Edward Highton, C.E.
J. Hixon, President, Holmfirth Mechanics' Institution.
Herbert M. Holmes, Hon. Local Secretary.
J. Holmes.
William Hooper.
Henry T. Hope.
R. Hopwood, President, Staley-bridge, Mech. Inst.
Rev. Dr. Hume, Hon. Local Secretary.
W. Burnley Hume.
Robert Hunt, F.R.S.
Rev. J. Hutchinson, President, Berkhampstead Mechanics' Institution.
S. B. Hutt, President, Cambridge Mechanics' Institute.
Captain Ibbetson, F.R.S.
Wotton Isaacson, President, Huntingdon Literary Inst.
W. S. Jackson, President, Shropshire Mechanics' Inst.
T. H. Jennens.
Henry Johnson.
Owen Jones.
Henry L. Keeling.
Wilhelm Klein, President, Red Hill Institute.
Alfred Lapworth.
J. R. Lavanchy.
Frederick Lawrence.
Rev. Charles Lee, President, Bilston Institute.
John Leighton, F.S.A.
Professor Leone Levi.
Stephen Lewis.
Dr. Waller Lewis.
W. S. Lindsay, M.P.
E. T. Loseby.
George Lowe, F.R.S.
Rev. Charles Mackenzie.
William Mackrell, Auditor.
Lord George Manners, Pres. Newmarket Lit. Inst.
John Manning, Pres. Cambridge Philo-Union Lit. Soc.
Horace Martin, Pres. Battle Mechanics' Institution.
C. P. Matthews, Pres. Romford Lit. and Mech. Inst.
Taverner John Miller, M.P.
N. Montefiore, President, London Jews and General Literary and Scientific Institution.
G. F. Morrell.
T. N. R. Morson.
William Mulready, R.A.
Andrew Murray, Pres. Portsea Watt Institute.
George Myers.
Dr. Nairne.
Henry Newall, Honorary Local Secretary.
J. A. Nicholay.
Matthew Noble.
J. S. Noldwritt, President, Literary and Scientific Institution, Walworth.
Professor Owen, F.R.S.
Thomas Page.
Sir John S. Pakington, Bart., M.P.
Philip Palmer.
General Sir Charles Pasley, K.C.B.
Henry Pease, M.P., President, Darlington Mechanics' Institution.
George Peel, Hon. Local Secretary.
Apsley Pellatt.
J. H. Pepper.
R. M. Perkins.
Robert Phillips.
Sir Thomas Phillips, Member of Council.
W. H. Pilkington, President, Clayton-le-Moors Institute.
Dr. H. Porter, President, Peterboro' Mechanics' Institute.
Dr. Spencer Pratt, President, Stamford Institution.
C. A. Preller.
John Procter.

Dr. Prior Purvis, President, Greenwich Useful Knowledge Society.
J. Allan Ransome.
Charles Ratcliff, Hon. Local Secretary.
Robert Rawlinson.
Alexander Redgrave.
Sir John Rennie.
Dr. Roget.
J. Rooker, President, Bideford Literary and Mech. Inst.
William Roupell, M.P.
J. Scott Russell, F.R.S., Vice-President.
J. Russell.
Arthur Ryland, Pres. Birmingham and Midland, Inst.
Bishop of St. Davids.
Thomas Sanctuary, President, Horsham Literary and Scientific Institution.
Sir H. P. Seale, Bart., President, Dartmouth Literary Institution
Major Scoones, President, Society of Literary Enquirers, Tunbridge.
W. B. Simpson.
Sir George Smart.
Sidney Smirke.
J. Jobson Smith.
James Snow, Pres., Lincoln Mechanics' Institution.
R. T. Spiers, Honorary Local Secretary.
J. R. Stebbing, President, Southampton Polytechnic Institution
Colonel W. H. Sykes, M.P., F.R.S.
R. W. Tamplin.
John Thimbleby, President, Barnet Institute.
Rev. T. Thomas, President Wellingborough Mechanics' Institution.
G. S. Tolson, President Huddersfield Mechanics' Inst.
Charles Towneley, President Burnley Mechanics' Inst.
Matthew Uzielli.
Cornelius Varley.
S. Waley.
J. H. Watherston.
Daniel Watney, jun.
W. Westley.
The Marquis of Westminster.
James Whatman, M.P.
Heywood Whitehead.
Josiah Wilkinson.
G. F. Wilson, F.R.S., Member of Council.
Thomas Winkworth, Vice-President.
F. A. Winsor.
Pres. Mechanics' Institute, Wisbech.
W. Wood, M.P.
M. Digby Wyatt.

P. Le Neve Foster, *Secretary.*
Charles Critchett, *Assistant Secretary.*
S. T. Davenport, *Financial Officer.*

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of *recent* Inventions.

Persons intending to contribute to the Exhibition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.

2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relative to this subject, has been prepared at the request of the Committee, by D. Roberton Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

SIR,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of

the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

	£	s.
T. D. Acland, Member of Council	5	5
J. G. Appold, Auditor	10	10
Harry Chester, Vice Pres.	10	10
Henry Cole, C.B., Vice Pres.	1	0
C. Wentworth Dilke, Vice Pres., Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley-Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice Pres.	20	0
The Master of the Mint, Member of Council (second donation)	10	10
Sir Thos. Phillips, Member of Council	5	5
Arthur Trevelyan	1	0
T. Twining, jun., Vice Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

EXAMINATIONS.—LOCAL BOARDS.

The following circular has been issued by the Central Committee of the Yorkshire Union, to the Institutions included in it :—

Central Committee, Mechanics' Institution,
Leeds, January, 1858.

Dear Sir,—We have the pleasure to inform you that arrangements are being made for the formation of Local Boards of Examination of Candidates for the Certificates of the Society of Arts, at the following places :—

Leeds.	Wakefield.	Hull.
Bradford	Sheffield.	Selby.
Halifax.	Middlesborough.	York.

The Examiners will meet in Easter week for the preliminary examination of the Candidates whose names will be forwarded to the Council of the Society of Arts in London, and printed Papers of Questions will be sent for the final Examinations of the Candidates, to take place in the week commencing Whit-Monday, 24th May.

The Examinations, which will comprise the subjects detailed in the Programme published by the Society of Arts, will be open to such Institutions as may desire to associate themselves with the Institutions where the Examinations are appointed, and each Institution so associated will be at liberty to send a representative to the Board of Examiners.

Should any of the members of your Institution be desirous of becoming candidates, you will please to communicate as early as possible with the Secretary of the Institution which you may deem the most convenient locality for your members to attend ; or, if you prefer it, we shall be happy to become the medium of communication.

We are, Dear Sir, Yours truly,
EDWD. BAINES, President.
JAMES HOLE, JAS. KITSON, Jun., } Hon. Secs.

COUNCIL MEETING.

Acting under the provisions of the Society's Bye-Law No. 74, the Council have elected His Majesty the King of Siam an Honorary Member of this Society.

TENTH ORDINARY MEETING.

Wednesday, Feb. 10, 1858.

The Tenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 10th inst., William Fairbairn, Esq., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Acworth, Rev. Wm.	Little, Thomas
Austin, Henry	Seguier, Frederick Peter
Brunlees, James, C.E.	Watton, William

The following Institutions have been taken into Union since the last announcement :—

454. Burnley, Mechanics' Institution.
455. Ashford, Mechanics' Institution.

The Paper read was :—

ON THE APPLICATION OF STEAM POWER TO THE CULTIVATION OF THE SOIL.

By J. Algernon Clarke.

Steam-power having been successfully applied to what may be called the mill-work of the farm, such as threshing, cutting, slicing, grinding, pulping, and preparing the various products and "feeding stuffs," entering into the economy of the farmyard, I take the present subject to be confined to operations in the field ; including drainage, preparatory tillage of all kinds, sowing, weeding, reaping, cartage of produce to suitable storing places, and the distribution of manure. And, lest a paper on these topics should extend to an unmanageable length, it will be advisable to be still more restricted, so that, waiving for the present a consideration of draining, manuring, sowing, and the light after-processes of tillage, I come to the first operation of breaking up the soil, and the mechanical preparation of a seed-bed as the main objects to be accomplished in steam cultivation.

Mr. Hoskyns, whose original views of this subject have moulded the designs of many inventors, and first fully awakened the agricultural world to the importance of steam-culture, teaches us to look beyond our familiar digging, ploughing, harrowing, scuffling, and rolling, as the sole possible modes in which the new motive-power may operate. We should analyse these processes ; see what is the end attained by them, and then endeavour to accomplish the desired result with a machine as specially adapted to steam-power, as the present horse and

hand implements are to animal-power. Investigating the nature of preparatory tillage, he finds it to consist in "comminution, aeration, and inversion," which it is possible to effect at once, in a single act, and with a simply-formed tilling instrument; and from the fact of horse-traction being horizontal, manual delving vertical, and the "favourite motion" of machine-work circular, he concludes (with an amount of argument and illustration which establishes and fortifies his deductions,) that some kind of "revolving cultivator" will ultimately be found best for being driven by a steam-engine. Accordingly, I am prepared to offer what, I believe, to be a new principle of rotary digging by steam-power, calculated to fulfil the various conditions recommended by theory or demanded by practice; but as an essay solely on mechanical tillage, so far advanced and a-head of the times, would be of little more immediate practical value than a history of past attempts and failures, I will first consider the application of steam-power to our existing order of implements.

At the outset let me remark that, although the "favourite motion" of steam machinery is circular, this is no valid reason why we should reject without trial every other kind of motion if suited to our purpose, seeing that the steam-engine employs rectilinear motion, continuous and reciprocating, and, indeed, all conceivable varieties of movement adapted to specific ends; and of all practical trials yet made, with the exception, perhaps, of Mr. Romaine's cultivator, far more favourable results have followed from applying steam-power to the haulage of traction implements, than from setting it to drive revolving cultivators. The wonderful rapidity with which steam-thrashing has been accomplished, is owing to the circumstance that there was really nothing new to do; the engine had to turn a sheave (to thrash a sheaf) by means of a driving belt, just as it was accustomed to do in thousands of factories, only it had to be made portable. But working over so great an area as the surface of a field is a novel operation for the steam-engine, beyond the mere application of cogwheels, shafting, belts and brasses; and there is difficulty enough in finding how to apply the motive-power at all points of the surface in succession without staying to devise, in addition, more perfect tillage implements than we now possess.

To draw an implement such as the plough, which has been tested, improved, and adapted throughout many centuries, is a simpler and readier problem than to contrive a new description of tool for performing a hitherto unknown operation, involving, perhaps, a novel system of cultivation altogether; and as in thrashing, the implement will doubtless be speedily improved when once the new power has been applied to it. Again, there is no doubt that intelligent farmers everywhere are prepared to work traction implements by steam, whenever they are convinced that the present ploughing, scarifying, &c., can be done at less cost, all things considered, than by horses. A steam-plough is capable of instant and universal adoption, while a new tilling machine would not only meet with mechanical difficulties, but be a long time in achieving practical and pecuniary success against customs and prejudices cherished for generations. It will be wise to imitate those processes which are now found to produce the best effects, even though this may not be making the most advantage of the power that is possible.

In practice it is found indispensable that the staple of the land should be occasionally inverted—to bury surface weeds, stubble, sward, or manure, and bring up root weeds for extraction; also to fertilize the soil by the chemical and mechanical effects which follow both the exposure of earth that has lain long buried, and the burial of that which has been long treated by rains, dews, winds, frosts, and sunshine. This inverting, indeed, may be said to constitute the heaviest labour of tillage; if we can perform this, we can readily master any after-stirring or pulverization. Breaking-up, without inversion, is getting into favour; but experience at Lois-Weedon and elsewhere shows that a tenacious subsoil should be exposed and weathered before being mingled with the staple. Mere granulation by scratching or rasping, mingling rather than turning over the mass so comminuted, has been proposed as the ideal operation we should aim to accomplish; but, however useful it may prove in some cases, I cannot regard it as calculated to meet all the necessities of our present practice, in which we find that, after certain crops and for various purposes, the soil must be cut or broken into pieces sufficiently large and tenacious to be turned bodily upside down. The pick or mattock may be a valuable tool in some countries—working with a minutely pulverising effect, and, at the same time, securing a more or less complete inversion—and the plough itself is in some climates a mere grubbing or ribbing tool; but with our moist soils and weeping atmosphere, our principal implements for performing the fundamental process of cultivation have been of necessity the plough that turns a furrow slice, and the spade that cuts and completely turns over a spit, the plough modified into many shapes, and the spade or fork made equally versatile in its adaptation to deep, shallow, light, strong, or stony land. Of these two implements the plough can be more easily actuated by steam-power than the spade: all hand tools being worked by several different motions intermittent and irregular, and so requiring complicated mechanism to imitate their action, while traction implements, moving with a continuous rectilinear motion, have simply to be drawn along, and with but little modification needful in their present form; hence, the solution of the steam-culture problem lying nearest to us consists in

Steam Ploughing.

On light land, and where shallow work alone is required, the breaking up and inversion of the soil is done with great efficiency by the plough; and when we see the neatness with which leas are "tucked down" by our first-class skim-coultered ploughs, precisely that toughness being left in the slice which is so desirable on such land, we cannot think that any better implement need be there desired. On heavy land, where tillage makes a larger item in the expenses of management, and a cheaper motive power than that of horses will prove the greatest boon, the plough seems to be used merely because the horses cannot dig. The sledging sole does harm; the slices, not sufficiently subdivided, harden and make work for future dragging and reducing; and inversion is imperfectly effected, because a "harrow-edge" is necessary for securing a good "mould." Deep culture is also needed on most strong lands; yet, the farther we dig below the surface, the more is our horizontal traction at a disadvantage. A vertically descending tool appears to be required rather than a horizontally drawn one; and, perhaps, rotary diggers will ultimately be found as peculiarly adapted for penetrating and stirring up the subsoil from great depths, as traction implements are for tilling the upper stratum. Such lands will be grateful for a digging or trenching machine driven (not dragged) by a steam engine, whenever it is practically brought to the field. Meanwhile, the most effective implement for deep work on a large scale, in which manual digging is precluded, is the plough, with the subsoiler or trench-plough following. However, in spite of Lois Weedon husbandry, and the larger experience of the Yester farms, deep tillage is not so much sought after at present as a more rapid and economical method of performing ordinary ploughing. Instead of the slow trenching machine (although necessary to the renovation of clay-land farming), everybody is asking for steam machinery that can plough or equally well cultivate, at comparatively small cost, a great area of ground in a little time.

Steam-ploughing is not only possible, but is being actually done on a considerable scale; and, without re-

citing the long history of inventions for the purpose, I wish to consider the various plans now before the public —the results as far as yet ascertained, and then to make suggestions for further progress.

The first point is—How to apply the power to the implement? and the next is, the construction of the plough or ploughing machine.

As the material to be cut and turned over cannot be "fed" to our machine, we must take the machine over every part of the surface to be acted upon. Is the motive power then to be transported bodily over the whole area, as horses are, or is it to be transmitted from a distance? The idea of a locomotive power was the earliest, and certainly the most natural, from observing horse-labour, besides being a corollary from the invention of steam-carriages. And though it may at first sight seem ridiculous to harness an engine to an implement, as though its strength, like that of a horse, lay in its legs, yet we have the example of the railway locomotive, which exerts all its power by means of its (rotary) legs, yokes itself in front of a carriage, and pulls with traces, as a horse does. Working on a level and smooth roadway, the locomotive can drag a train of carriages more economically than a stationary engine can haul it with rope; and, allowing for the difference between a galloping railway speed and the sluggish pace required on an arable field, analogy would lead us to expect a like superiority of the locomotive, whether in pulling ploughs or vehicles. I need not enumerate all the attempts at locomotive engines for traversing arable land, but shall notice two only, one "theoretical," the other practical.

The great weight of a steam-engine, with its water and coal, forms the chief obstacle to its transit over a soft or rugged surface; why not, therefore, employ a pneumatic locomotive? In 1839, Mr. Henry Pinkus patented a most ingenious method of applying an atmospheric vacuum, or else compressed air, as an auxiliary for conveying motive-power from a stationary engine to travelling implements. Now, without adopting his proposal of laying down air main-pipes about an estate, and distributing power (as Mr. Mechi does manure) from steam-pumps at the central homestead, might we not take his plan for connecting a light travelling pneumatic engine with air-pumps attached to a stationary portable steam-engine? A flexible tube, coiled on a cage-drum upon the pneumatic locomotive, is paid out as the locomotive recedes from the steam-engine, and wound up as it approaches. By passing and repassing the steam-engine, a length of 200 yards may be ploughed with only half that length of pipe, and as this is merely laid down and rolled up again, very little wear from friction is incurred.

All doubt as to the effectiveness of pneumatic power applied in this way may now be considered as dispelled by the success of a compressed air engine at Govan colliery, near Glasgow, which has been working for more than six years without requiring any repairs or adjustment. The air-engine is situated half-a-mile from the steam-engine and compressing-pump, yet, as the pipe conveying the air is of large diameter, viz., 10 inches, the pressure of the air is diminished only 1lb. per square inch in passing through it. However, there is so much nicety and complication necessary in the compressing machinery, and in the apparatus for neutralising the great development of heat occasioned by the process of obtaining air at only 20lbs. pressure to the inch, that I think the principle must be abandoned, and we must give up, at any rate for a long time, the advantage of possessing such an extremely light as well as powerful locomotive power in our fields.

For making the steam-engine itself an agricultural locomotive, we have Mr. Boydell's "endless railway engine." I need not describe in detail this admirable working-out of an old idea. By bridging over hollows and forming inclined planes over obstacles; by stepping, as it were, instead of rolling, and laying down smooth even iron rails on which the wheels run; and still further, by bearing with flat platforms instead of curved wheel-tires upon soft ground, the shoes or rail pieces marvellously ease the progress of a ponderous machine. And thus the "traction-engine" can climb considerable gradients, as proved at the Salisbury agricultural meeting: and whether we adopt the particular form of engine there exhibited; or Mr. Burrell's appliance of the rails to common portable engines; or Messrs. Tuxford's compact and manageable engine on three wheels, in which both the main travelling wheels are driven, whether turning a curve or proceeding in a straight line; or Mr. Collinson Hall's enormously high-pressure locomotive, with its peculiarly-shaped boiler and steam-chamber maintaining the water levels always above the tubes,—it is now clear that the farmer's engine may be independent of his horses, that it can draw from farm to farm the heavy threshing machine it works, and pull home the harvest sheaves or lead out those loads of farm manure which now tax the power of our teams so many weeks in the year. From the many experiments made and published, it is certain that the "steam-horse" can drag implements in moderately level land at a very expeditious and cheap rate; which is not surprising when we consider that the engine brings the implements, the coal and water enough for the day's use into the field with it; that no tackle has to be laid out and fixed, or taken up and shifted, that the amount of manual labour required is very small, and the time lost in turning and removing comparatively trifling.

How long a traction engine will last in constant field use I am unable to say; but everybody knows how the rough journeys of common portable engines tend to damage and deteriorate them; and though the rails prevent much of the shock and strain which would be otherwise felt, continual travelling over a hard and rugged surface like arable land must have an injurious effect upon a ponderous boiler and machinery. The wear of the rails is also a very serious item. The objection that the great weight is calculated to injure a strong soil by undue consolidation, applies to the traction engine as well as to horses, but not with greater force. For an engine of 8 or 10 tons traversing a field weighs but little more than the number of horses requisite to pull the same implements; and their feet penetrate and injure the ground more deeply than the broad platform rails.

It appears that a momentary emergence of the tubes above the water level in the boiler is not dangerous; but for maintaining a nearly horizontal position upon long inclines, might not ordinary boilers be supported about the middle of their length, and raised or lowered at one end by means of an adjusting screw?

I am very hopeful of the extensive adoption of the traction engine upon very level land, for ploughing or scarifying whole ground; but fear it would be impracticable for working land already ploughed, so much of the motive-power being wasted in carrying itself over rough and yielding furrows or large clods.

It is to be regretted that the adaptation of the ploughs to the traction engine has hitherto been so unfortunate as to prevent the accomplishment of a high quality of work. Mr. Smith, of Woolston, has just patented an improvement in the yoking of the implements.

Before quitting the subject of locomotive engines for traction, I ought to mention Mr. Halkett's recently-proposed system of "guideways," or rails laid 50 feet apart over the entire surface of the land, for the conveyance of the engine and tilling machinery. The advantages promised on clay soils are prodigious, but I believe not the less reasonable and likely to be realised; and I would dwell longer upon the mechanical merits and economy of the plan, did I not believe that the first outlay, of £25 to £30 an acre, effectually debars its employment to the tenant farmer, while there are but few estates, I suppose, on which landowners are likely to apply

it, or on which a public company might obtain power to operate. And I prefer to notice schemes of steam culture for tilling our fields as at present laid out, as more immediately practicable and available than those requiring the complete remodelling of estates.

For ploughing, and scarifying, &c., in a hilly country, we must have recourse to the windlass and rope as the best means of transmitting power from the engine to the implement; and it is a question whether this or the traction engine principle is best even for level districts.

Of several plans which have come before the public for working implements by a stationary engine and windlass, only one now survives. Mr. Fowler, having tried one method which wasted too much time in shifting the anchorages, and another which, though with these self-shifting, required a great length of rope, has adopted the system of moving both engine and windlass along the headland. Mr. Smith, of Woolston, adheres to the stationary engine and windlass; for though it involves the use and wear of wire-rope laid all round the field instead of once up and down it, and loss of power also in passing the rope round four anchored pulleys instead of only one, it enables him to employ a very compact form of winding-machine or capstan, and relieves him of the difficulty of moving the heavy machinery along the headland. The anchors at both ends of the work are removed at intervals into holes dug for them by hand labour, and a man is necessary to guide the rope into proper coils on the drums; so that with the engine-man, and a man and boy with the implement, five men and a boy are engaged in working the machinery, besides the horse and hands fetching water. The working cost of deeply breaking-up the soil, at 5 acres a day, including the shifting of the tackle, is 5s. 2d.; and of trenching and subsoiling (3 acres a day) 8s. 8d. per acre; the wear and tear being taken at 1s. 6d. per acre more. The price of the tackle and implement adapted to a common portable seven-horse engine is £220; and the experience of several farmers seems to show that it is worth while to lay out this sum, and then expend the above amount per acre for autumn cleaning and other preparations, even though ploughing itself may be left for horse-labour.

Mr. Smith's method of turning the implement at the end of its course, by simply having it yoked to the ropes by a "turn-bow" or hook in front, is the simplest and readiest possible. I shall refer to his system of tillage by-and-bye; ordinary "ploughing" not being included in it.

But may not this hauling by wire-rope with a stationary engine be pushed too far? When a very great length of running rope is out, the friction of the slack portions of the rope on the ground (the tight parts resting on friction-rollers), that of the pulleys or snatch-blocks on their bearings, the bending of the rope round the pulleys, and other conditions, consume a very considerable amount of power, besides occasioning a large amount of wear; and our object should, therefore, be to place the engine as near its work as may be consistent with no undue loss of time in shifting anchorages and turning the implement at the ends. This was the principle acted upon in the earliest practical trials of steam-ploughing, a medium between the travelling and fixed motive-power being chosen, by arranging the engine with its winding-mechanism upon the headland, and shifting it so as to be always opposite the ploughing. If we have two engines with coiling drums, one at each end of the field, and two implements moving in opposite directions, the ploughs will be at the least possible average distance from the motive-power. However, the very great prime cost, the cumbersomeness and difficulty of moving so much heavy machinery from field to field, the time lost in adjusting the two implements at the end of their work, and other considerations, are unfavourable to the scheme, except when ploughing is undertaken on a scale of great magnitude, and the engines are constructed so as to be perfectly capable of steaming their own way from farm to farm. A better plan (indeed, the first ever brought into actual operation) is to employ one engine and winding-gear on one headland, and an anchorage and pulley on the other, both being shifted along as the work proceeds, and a single frame of ploughs being hauled up to the engine or pulley alternately. This is the plan adopted by Mr. Fowler; and, for comparing the saving of power effected, suppose a plot to be ploughed is 200 yards square, with a stationary engine and windlass the average length of rope running at once would be 600 yards, and the average distance of the implement from the windlass 300 yards; with a shifting engine and windlass, the average length of rope out is 400 yards, and the average distance of the implement 200, that is, one-third less. There is a further economy of power in having a direct pull upon the plough with one rope, and round only one pulley with the other, instead of round two pulleys with both ropes, as in the stationary windlass method. There is, therefore no doubt that Mr. Fowler could haul Mr. Smith's implements with greater results than have yet been attained by the latter gentleman's rectangular method of working the rope; so that it is the simplicity and lightness of machinery and apparatus, rather than economy in working expense, which form the favourable points of the Woolston system. One advantage of Mr. Fowler's plan is also that an unlimited extent of land may be ploughed with the same length of rope, fewer removals of the engine and tackle by men and horses being therefore required. I need not describe his ingenious anchorage, which propels itself onward, with its cutting disc-wheels always in the soil, forming a perpetual holdfast or purchase, or the well-known engine with coiling-drums underneath, which also slowly creeps forward along the headland. A portable engine, by its inherent weight, forms such a capital fulcrum or resistance against the strain of the hauling-rope, that it was well to use it as such; but until we have the combined engine and windlass able to transport itself up-hill and along ordinary farm roads, I must view it as too ponderous and unwieldy for common farm use. One material point should be considered, namely, that to be immediately useful and successful, and patronized by the farmers generally, a steam-plough ought to be adapted to our present portable threshing engines, now distributed by perhaps tens of thousands throughout the the kingdom. Mr. Williams, of Baydon, connects a windlass on wheels with a portable engine, by means of a strong framing; and though he has not been able, I believe, to work his ploughs without horses assisting, this portion of his plan is on precisely the principle I regard as most feasible and likely to meet with general favour. Mr. Fowler has adopted a similar method of enabling the farmer to avail himself of the engine he already possesses—the windlass-frame, mounted on large wheels, being so constructed as to embrace an ordinary engine like a pair of shafts, one end of the boiler being supported on this frame, and the other remaining upon its own travelling wheels. It does not take much time to unite or separate the engine and windlass; when joined, they propel themselves forward on the headland as one machine, and when separated, three horses can take either part from place to place.

At the trial at Stirling, Mr. Fowler's machinery, manufactured by Messrs. Ransomes and Sims, ploughed heavy land $5\frac{1}{2}$ inches deep, at the rate of $6\frac{3}{4}$ acres a day, for a total estimated cost of about 8s. per acre, which by horse-labour would have been 15s. per acre. On milder soil, 7 inches deep, at the rate of $9\frac{1}{2}$ acres a day, for about 6s. per acre, which by horses would have been 8s. per acre; and the trenching implement going $12\frac{1}{2}$ inches deep, ploughed at the rate of 5 acres a day, at say 11s. per acre, work which would need 6 horses for accomplishing only one acre in a day. The saving in the cost of ploughing we may reckon 35 per cent. on the loamy land, 40 per cent. on the heavy land, and say 60 per cent. in trenching; and it is here obser-

vable that the economical advantage of steam over horse-power is in proportion to the difficulty of the operation, whether arising from the stubbornness of the ground, or the depth of the tillage. The superior quality of the work, and the great benefit of turning over the furrow-slices with a rapid motion, and with no damaging pressure either by the plough-soles or by horses' hoofs, were points equally well demonstrated on that as on many other occasions.

The adoption of a shifting engine and windlass, I view as one of the best steps taken for cheapening the operation of steam-ploughing, a step that economises power, saves time, curtails labour, diminishes wear and tear, and lessens the first cost of machinery and tackle. For working scarifiers and other implements taking a great breadth at once, perhaps it would be well to employ Mr. Smith's removable anchors, instead of the self-shifting one.

Mr. Fowler's latest advance has been to triumph over one of the defects hitherto found in the coiling of the ropes upon the drums; he has dispensed with the man for regulating the winding on, and escaped the wear caused by the grinding and sawing action of the coils of rope upon each other, by giving up winding altogether and leading the rope round grooves in the drums. He is thus enabled also to keep every portion of the rope sufficiently tight to be held off the ground by the friction-roller barrows, so that the wear is amazingly reduced. The total length of rope is also lessened by one-third, and is now less than half that required for a field of given size by the rectangular method. Only eight hundred yards of rope are required for ploughing four hundred yards length of furrow, and the price of the entire apparatus for a 7-horse engine is £280. The hands required are only two men and three boys, besides the water-carters. I should also add here, that scarifier tines have been adapted to the plough frame, so that either ploughing or grubbing can be effected by the same implement; and, of course, any traction implement whatever, as for instance, Mr. Smith's subsoilers or scarifiers may be worked by the same tackle.

There are many districts in which the fields are generally too precipitous for the easy passage of an ordinary engine from side to side, much less to admit of a locomotive traction engine climbing over all parts of the surface. In such cases we must fall back upon the stationary engine; and we may adopt the direct hauling from a fixed capstan, ropes laid out in a rectangular form, and anchorages self-shifting like Mr. Fowler's, or removed by hand in Mr. Smith's manner, or we may save the wear of wire rope, and secure a light apparatus, by employing the travelling windlass of the Messrs. Fisken. In this arrangement the wire rope is fixed, being fastened to self-shifting anchorages at the ends of the work, and the windlass, with implements attached, winds itself along the rope from end to end, motion being communicated from the engine in one corner of the field to the rigger, gear work, and coiling drums on the windlass, by an endless hemp cord mounted upon frames with friction rollers, while, in order that this cord may be very light, it is driven at a high velocity. There are many advantageous points in this invention—the complete control which one man has over the windlass and implements, so as to stop or return at pleasure without signalling of any kind, and the facility with which the tackle can be removed from place to place being among the number, and it is to be much regretted that we no longer find it in a practical form before the public.

The hemp rope (manufactured so as to be impervious to wet) is so convenient for transmitting power, and I believe not liable to the rapid wearing out that we might suppose, that I will now offer a suggestion for its application in steep districts, where a shifting engine may be inadmissible; and here I would observe, that this paper is intended to be suggestive of mechanical improvements rather than a narrative of the achievements and performances of particular inventions. I believe that ideas are wanted, and beg to submit for your consideration a number of proposals with the diffidence becoming one who propounds methods deduced from theoretical considerations, from observations of the schemes of others tried on a great scale, and from mere working model and garden experiments of his own.

Suppose a windlass mounted on wheels not to travel up and down the field, but simply to shift itself along the headland as required, and hauling an implement by wire ropes and an anchorage, as in Mr. Fowler's plan. Let there be cutting discs (like those in Mr. Fowler's anchorage), to prevent the windlass from slipping sideways, and let an endless hemp rope transmit motion to a large grooved rigger on the windlass from a similar one on the engine at one corner of the field. I think a windlass with drums on a horizontal axis would be most compact and simple, and in order to permit of ploughing at various angles to the direction of the headland, the travelling wheels of the windlass frame might be capable of being more or less locked, so that it could advance as it were in an angular or diagonal direction, while the axes of the winding drums still remained at right angles to the line of ploughing. Mr. Fowler's grooved barrels would, however, be still better.

In re-modelling and modernising this essay, which was written a year ago, I am gratified to find that one of my principal suggestions has now been superseded by Mr. Fowler's simple method of temporarily uniting portable windlasses with an ordinary engine. I will merely state briefly that my proposal was to connect such a shifting and independent windlass as that just described with a portable engine, by means of a beam or bar fastened to the windlass-frame at one end, and to the axle trees of the engine at the other, provision being made for slightly locking the front wheels of the engine when required for steering. This beam was to be in two parts, with a right and left hand screw for altering its length, so as to regulate the distance of the engine from the windlass, and maintain the proper tension of the driving belt or rope. And the engine might be either shod with the "endless rails," or, more clumsily, travel upon a couple of short planks, laid down before and taken up behind it by hand labour, as in Lord Willoughby d'Eresby's plan.

I will now ask whether we may not relieve the anchorage of most of the present strain, and so have it of the lightest and simplest form, employ much less heavy rope, avoid the delays and hazards of "signalling," and save time at the ends by making the whole operation more automatic than at present. Suppose we give up the to-and-fro work with a single implement, and use two implements, ploughing always one way, namely, up to the windlass, one implement going backward empty while the other is in work. That part of the rope passing round the anchored pulley having only the draught of an implement out of work, and one length of slack rope to haul, may be very light indeed, and the anchorage correspondingly light and portable. No time would be lost in directing the implement into a fresh course, as each implement is steered as it travels backward precisely into the position from which it has to start. Directly one implement arrives at the windlass the other is ready to commence its journey, and perhaps the implement might itself "reverse" the winding drums by coming in contact with a lever connected with the clutches for this purpose, so that the change of motion might be almost instantaneous, and the ploughing perpetual and continuous. When it is considered that we now lose an hour or an hour and a-half in a day in changing, &c., at the ends of the work, the advantage of this plan is obvious. It is most applicable to ploughing in "lands" or "stetches," the track of one implement always the breadth of one bout from that of the other (as will be presently adverted to); but for flat work, in which the furrows are all thrown one way, crossing of the ropes would occur. This, however, merely requires the slack rope to be lifted over the plough in work, and the plough

returning empty to cross over the tight rope. For accommodating the length of the small rope passing round the pulley, to the varying lengths of the furrow in different parts of a field, it must be shortened or let out from time to time by means of a few reserve coils carried upon the ploughs. It would be an improvement upon the present mode of hooking the draught ropes to the implement if a "clip" were made use of, which could be instantly released by the ploughman; or if the ropes wrapped round a small barrel, held from rotating by a catch, and allowed to revolve when the pull or draught may be required to be stopped, in consequence of a stone, root, or other obstacle suddenly arresting the progress of the plough.

I now come to the second point—the construction of the plough or ploughing machine. And in the outset I would observe that we require a ploughing *machine*, and not merely a means of yoking separate ploughs held by men as before. When there no longer remain any animals to drive, and we have a steady, uniform unflagging draught-power, why are we to retain the workman in a mechanical employment, and thus perpetuate our dependence upon his unskilfulness, carelessness, or fatigue? When once relieved from the co-operation of horses, having voluntary movements and wills of their own, ploughing becomes a strictly mechanical operation; the attention and directing judgment of the ploughman are no longer necessary to overrule the animal power, and accommodate the implement to its movements; and therefore I regard as incongruous and objectionable all projects for steam culture with ordinary horse-ploughs held by hand. They are also expensive in labour, requiring more workmen than a ploughing machine does for the same number of furrows; and they are awkward, owing to the difficulty of conducting a succession of ploughs close up to the headland, and turning or shifting them for the return course. Contrivances for meeting this difficulty I cannot but look upon as wasting ingenuity in a wrong direction.

Mr. Williams, Mr. Fowler, and other inventors, have practically demonstrated that several ploughshares and mould-boards united in a single frame may not only make very good work, but also be of considerably lighter draught than single and separate ploughs, taking an equal number of furrows. Not only is the draught less, but power is gained in another way, by combining a considerable number of ploughs together. A rope pulling three ploughs, at a speed of three miles per hour, is dragged twice as far in the same time as a rope hauling six ploughs at 1½ miles per hour; that is, the power wasted in dragging the rope itself is double in the former case what it is in the latter, for the same quantity of work turned over, to say nothing of the double amount of wear. There is also a saving of time. If a three-furrow plough traverse the field in three minutes, and waste one minute at the end, one quarter of the day is sacrificed out of work; whereas, if a six-furrow plough perform the journey in six minutes, the one minute at the end amounts to only one-seventh of the day. Let these considerations be borne in mind, while we proceed to notice various forms of ploughing machine used or proposed.

They are of two kinds—one for flat work, in which the furrows are all thrown one way; and the other for making "lands" or "stetches."

Turnwrest, one-way, or flat ploughing is adapted for light land, and may be practised also upon well-drained strong soils. The most successful steam-ploughs have hitherto been those constructed for this description of work, the advantage attending it being, that an implement, taking three or more furrows at once, can be worked without requiring to be turned round at the ends, and with anchorages gradually shifting along the headlands; whereas, in ridge-and furrow ploughing, such an implement must be moved across to the other side of the "land" or "ridge," and the anchorages shifted a considerable distance forward or backward at every bout; while laying out the slack rope in the next track so far from the plough is also a difficulty. The implement having a simple to-and-fro motion, and the furrows all thrown the same side, it would appear at first sight very easy to fix two or three or more of Lowcock's turnwrest ploughs (with shares pointing both ways and self-adjusting mould-boards) in a frame, after the manner of the common double-furrow plough. But the difficulty is, that the ploughs must change their position sideways at each end of the work, in order to "track" rightly in going opposite ways. Lord Willoughby d'Eresby has displayed great ingenuity in providing for this necessity, but the space required for allowing the ploughs to pass each other places one so far behind another, and time lost in adjusting them is so considerable, that the principle is objectionable. There seems no other course than to have duplicate sets of ploughs pointing in different directions, one carried in the air while the other is at work. Messrs. Fisken attach the ploughs to the ends of their windlass-framework, travelling upon two pairs of wheels, one set at each end, and both pointing towards the carriage. The set out of work precedes, while that in work follows the windlass-carriage, the ploughs in each set being just far enough apart to allow the furrow-slices to turn over without danger of choking. Each plough-body is affixed to a separate lever, answering to the common plough-beam, and by very simple mechanism is raised or depressed at pleasure. Thus, instead of the ploughs entering or emerging from the soil simultaneously, they do so in succession, so as to plough square up to the headlands. In the system of direct-hauling by wire-rope, in which it is indispensable to avoid unnecessary mechanism, in order to have the implement as light and simple as possible, we can hardly expect such niceties as this; and, instead of an arrangement of levers, chains, screws, and sockets for lifting and lowering the ploughs individually, I can imagine no better principle than that of balancing two sets of fixed ploughs upon a single pair of wheels, as adopted by Mr. Fowler. The frame, hung midway upon the wheels, with a set of ploughs at each end, is tilted so as to bring the hindmost set into work; and when arrived at the headland, the attendant has simply to pull down the other end and steer the implement in its next course when the rope begins to move it onward. The two sets of ploughs are immoveably fixed upon the framing, pointing toward each other; the wheels, one running in the bottom of the furrow, left open at the last course, the other on the unploughed land, regulate depth and width of work, like the wheels of a horse-plough; and, by means of screws working in vertical standards, the frame can be adjusted upon the axle tree, according to the depth of ploughing required. The steerage is accurately effected by slightly "locking" the wheels with a regulating screw, under the command of the ploughman, who rides upon the tail of the frame.

I attach great importance to the saving of time at the ends; and this is one reason for approving of the simple construction and action of Mr. Fowler's plough. One of the main advantages of this implement is the lightness of its draught. From numerous experiments with the dynamometer, it appears that the draught of common horse-ploughs, when out of work, is 30 to 35 per cent. of their draught when ploughing an ordinary furrow. Now, in Mr. Fowler's implement, this sliding of the weight of the ploughs on the furrow bottom, is entirely avoided, the ploughs at one end of the frame balancing those at the other, so that the entire weight is carried upon the large patent-axled travelling wheels. I have tested the draught of the 4 furrow plough running empty upon the surface of the land, and found it to be only 3 cwt.; the draught of 472 yards of wire rope dragging along the surface of a clover lea, was 3 cwt.; the total draught of implement and rope being no more than that of 4 common ploughs drawn empty on the same surface. Of course,

with the rope supported upon friction rollers, the actual draught is much less.

I would suggest as an improvement, that this plough should be constructed say with two beams of ⊥ iron shorter than the present wood beams, and with two diagonally placed beams at each end, made of tubular or angle iron, on which the plough skifes or the scarifying tines might be adjusted by clasps or bolts and screws, for different widths of furrow.

This implement which, by ready alterations can plough ordinary furrows, trench two furrows deep with an effect equal, in dry weather, to that of the spade, break up either whole or ploughed ground by cultivator tines, or pare with broadshares, seems to me just the convertible valuable implement we need in connection with steam-hauling machinery, as this versatility so materially reduces our first outlay.

I now pass on to a consideration of ploughing in lands, ridges, or stetches.

Steam-tillage ought to prove of the greatest assistance to heavy lands, and not only to light lands, which may claim the reaping machine as their gift from the mechanic, it being specially adapted to their upstanding crops; and from the restricted area of permanent subsoil-drainage yet in existence, as well as other circumstances, the great majority of farms on our strong wheat-soils are undoubtedly ploughed, and I fear must for many years be ploughed in ridge-and-furrow "lands."

It would be possible to form a land with Mr. Fowler's plough, first going two courses (that is, once up and down the field,) on one side of the ridge, and then, with considerable loss of time, turning the plough end for end, and going two courses to complete the other side; but, still better, the ploughs at one end of the frame might be left-hand, and the other right-hand ploughs, the implement then not being turned round. The slack or return ply of the rope following the plough would have to be laid out sometimes half a land's breadth aside from the track, and a guide wheel running along the last open furrow would be necessary to regulate the parallel distance of the next ridge. The anchorage, I think, would simply need to be shifted half a land's breadth at a time. But there is one objection. When we consider that one of the chief points of good ploughing is to form the sectional contour of the land in a proper curve, so that every furrow-slice shall be lower in regular gradation as we recede from the ridge (in order that the harrow edges of all may be equally prominent); and when we remember that a skilful ploughman secures this form by adjusting the width, depth, &c., of each furrow according to its distance from and relation to the ridge or water furrow, and according to the previous shape of the ground, we perceive that no implement ploughing all its furrows one unvarying depth and breadth can be well calculated for this description of work. Perhaps Mr. Fowler may improve his ploughing-machine for stetch work, by giving the workman power to alter the depth of either side of the frame without stopping for the purpose.

Mr. Williams suspends his single set of ploughs upon levers capable of working vertically in a carriage-frame, each plough being independently raised or lowered, but the machine has to be turned round at each end of the work at every course, and taken across to the other side of the land—a difficulty which I believe Mr. Williams has not yet overcome without the use of horses—and the alterations of depth, &c., necessary for different courses, must occasion considerable delay. But it is unnecessary for each plough to have a "swimming" motion independent of the rest. There appears to be no practical obstacle to the employment of a considerable number of ploughs rigidly fixed in a frame, but, on the contrary, the lightness of framing and adjustments in proportion to the breadth of ground operated upon (so important in lessening the load to be drawn) is in favour of such an arrangement. We might take half a "land" at a time, if the machine would not be too cumbrous, so that when the ploughs are once "set" (with regulating screws, &c.), to their proper depth and position, according to the form of the surface to be ploughed, no alteration whatever would be necessary. But a frame of six or seven ploughs following each other, would be too long and unwieldy, therefore, let us turn half the furrows one way and half the other, the ploughs being in two sets, placed abreast, instead of following one another. The six ploughs will thus occupy only the same length of frame as three; the machine, indeed, with wheels in front and behind, will be of much the same dimensions as a scarifier. Mr. Coleman exhibited at Chelmsford a ploughing machine of this description, in which the ploughs were arranged in a V form, like a flock of wild fowl. Suppose we attach the ploughs to the bars or beams of the framework by a fastening somewhat similar to that of Bentall's broadsharer, so that they can be adjusted to different depths and widths, according as the ground may be level or in ridge and furrow. By raising the fore-end of the frame upon its carriage wheels (with a wheel-and-screw or lever movement), the ploughs are run out of work of their own accord, and by depressing the front, they are pointed in. Let there be two implements, ploughing only up to the windlass—in accordance with the method of hauling described in a previous part of this paper. One is to "gather," or turn its furrows inwards, forming a ridge in the middle, the other is to "split," throwing its furrows outwards, leaving an open water furrow in the middle; that is, the first implement makes "ridges," or "feerings," of a certain distance apart, and the other "makes up" the intervals, forming complete lands or stetches. Carriage wheels follow in the last furrows to sustain the weight of the implements, and for them to travel upon as they run backwards out of work. The manner in which the two implements would be worked, with a minimum of time lost at the ends, and a saving of power in several respects, has been already sufficiently described. I need merely refer now to the advantages of making the ploughs in each frame turn half their work opposite ways, and to the possibility of lightening the draught by avoiding sledging and sliding action as much as possible.

From numerous dynamometer experiments, it appears that in a heavy soil, if the whole draught of a plough in work be taken as 100, then, with the mould-board removed, it will be 90, drawn along an empty furrow it will be no less than 35, leaving 55 to represent the power required for cutting the slice. Much of the 35 per cent. may be saved by supporting the implement upon three or else four carriage-wheels, and shortening the sole as far as it can be done without causing the share to make a ragged uneven furrow-bottom. The 10 per cent. due to the action of the mould-board may also be reduced; for though the weight and friction of the soil upon the upper surface of the mould will remain, the weight lifted (several stones) may be mainly sustained by the traveling wheels, instead of borne by the sledge formed of the sole and the heel of the mould-board. The 55 per cent. due to the operation of the share and coulter, must not be supposed to arise merely from the dividing of the soil by their cutting edges; the share has a considerable weight of earth resting upon it, not only occasioning great friction upon the upper surface of the share (which cannot be obviated), but greatly adding to the pressure and friction of the under side of the share upon the furrow bottom. By forming the ploughs in our machine so that no part shall touch the furrow bottom, except a small portion of the share edges and soles, and by bearing the entire weight upon wheels of considerable diameter and broad peripheries, (or, perhaps, applying the "endless rails" to prevent sinking,) a very large proportion of the friction, cohesion, etc., of the horse plough may be dispensed with. There is also another consideration. A common plough exerts a great side pressure against the upright land side of the furrow, owing partly to the re-

action of the furrow slice in turning over sideways, but principally occasioned by the diagonal direction of the share's cut. If the cutting edge of the share make an angle of 45° with the direction of the plough's advance, there will be a pressure against the side of the furrow equal to that needed to overcome the resistance directly in front of the share. But when we fix two sets of ploughs in a frame, half having right hand, and half left hand shares, instead of any side thrusts being taken with a sliding action upon the face of the furrow, the side-pressures of all the ploughs neutralize each other. By proper attention to these points, I conceive that an economy of power would result.

I have not time to detail the simple steerage by slightly locking the axle of the front wheels, the adjusting of the hind wheels to make them act partially as "soles" to the ploughs, or the short coil of reserve rope and the clip by which it is held. I need merely add that all the arrangements might be very simple, and that the implements would travel with their wheels partly running on the unploughed ground, but chiefly along the smooth and clean furrow bottoms, and only for an instant cross over the ploughed land. Of course the draught of a large implement taking six furrows at once must be heavy, but the load is sustained by the windlass and not by the anchorage. Perhaps the chief objection is the difficulty of making furrows of equal depth on uneven land by an implement of such great width.

Having now concluded my review of steam-ploughing properly so-called, and offered various suggestions for its better accomplishment, I must briefly allude to

NEW PROCESSES, ROTARY FORKING AND DIGGING.

First. *Implements operating by Traction.*—Mr. Smith, of Woolston, is very successfully carrying out a novel system of tillage, by means of trenching, subsoiling, and grubbing implements, without using the common plough, except for turning over clover lea and sward land, and this, indeed, he thinks to be hardly necessary. He combines subsoiling tines with the double mould-board plough, and follows with the single subsoiler, so that the land is left ploughed up in "drills" or "ridges," the subsoil at the bottom of the open furrows and trenches broken up and exposed to the atmosphere, while the strips of ground covered by the upturned furrow slices are also stirred and disintegrated. On all soils that are not thin or light, this must be a remarkably effectual fallow process; the partial inversion and complete stirring exposing such a large proportion of the staple and subsoil to atmospheric action. The subsoiling tines are exceedingly efficient, somewhat resembling spades, or square fluked anchors, in shape, and so sloped as not only to enter and pulverize deeply the entire breadth of a furrow each, but also to raise a considerable portion of the subsoil for admixture with the upper staple. And the various cultivators used (manufactured by Messrs. Howard, of Bedford,) are remarkably simple, strong, and effective, and possess very admirable contrivances for steering, raising and lowering, and turning round. My paper being confined to mechanical methods of applying steam power to tillage, rather than referring to tillage itself, I say no more here, except that Mr. Smith's land and crops testify to the soundness and value of his husbandry upon very heavy and also upon some other qualities of land; and his experience, fortified by that of various agriculturists, shows that there is economy in expeditiously breaking up ground by these implements at a total expense of 6s. 6d. to 10s. per acre.

We have been long familiar with the revolving harrow, forker, or scarifier, as brought before the public by Mr. Gibson, of Newcastle-upon-Tyne, Mr. Samuelson, of Banbury, and other inventors. And I believe the decision of practical judges respecting them to be that, while they may be admirable in certain cases for stirring ground already tilled, they are not able properly to break up and invert unploughed land. However, I do not quite despair of this form of digger for effecting the first and principal operation of tillage. Mr. Smith, of Lois-Weedon, has contrived an implement of this kind which answers perfectly well for pulverising and lifting up the subsoil from the bottom of the trenches previously ploughed along his "intervals," casting the furrow-slices of staple underneath, and depositing the subsoil upon the top. The tines (of proper cycloidal curve), instead of being arranged upon separate discs, forming a set of independently-revolving rowels, are all fixed upon one barrel; as the machine advances, the earth is crumbled and raised bodily by the teeth, and while it hangs momentarily suspended in air before being cast off by fixed scrapers, a couple of small mould-boards gather the upper soil (previously turned by a plough) on each side into the bottom of the trench, the earth from the digger falling upon it.

Could not a simple implement of this character be made for ordinary husbandry, in which the whole surface has to be cultivated? Suppose a similar digging cylinder or wheel, to take only the width of a common furrow, preceded by a couple of skim-coulters or small ploughs, that would pare the stubble or sward, and cast it into the furrow left open at the previous course; then the earth raised by the digger might be diverted as it fell by a sloping mould-board, and laid upon the top of the thin slice deposited by the skim-coulters. In this way a perfect inversion and burying of the surface would be secured, while at the same time there would be a thorough comminution of the soil, and no pressure or sledging upon the furrow bottom. I think the draught of such an implement would be comparatively light, as the weight would all be supported upon the axis of the digging-wheel, and help to force the tines into the ground. The implement would also be very convertible; for, by taking off the mould-board we should have a rotary subsoiler instead of a trencher, the soil being mixed instead of inverted; and by adding other digging-barrels on each side, we might have a wide grubber or cultivator. For the purpose first mentioned—that of ploughing or trenching better than the plough—perhaps it would be equally efficient with the combined implement, proposed I believe by Mr. Fowler, in which a furrow-slice is ploughed the full depth, turned precisely upside-down, and then broken by the points of Norwegian-harrow rowells following upon it.

Hanson's potato forker is another form of rotating pulverizer; could not Mr. Fowler apply the revolving blades or tines to cut the furrow slices of his plough crosswise? Motion might be derived from one of the travelling wheels, and thus ploughing and pulverizing would be accomplished in a single act.

Leaving now the traction principle altogether, which, in the case both of ploughing and scarifying by steam must be now pronounced fully successful, let us inquire into the merits of

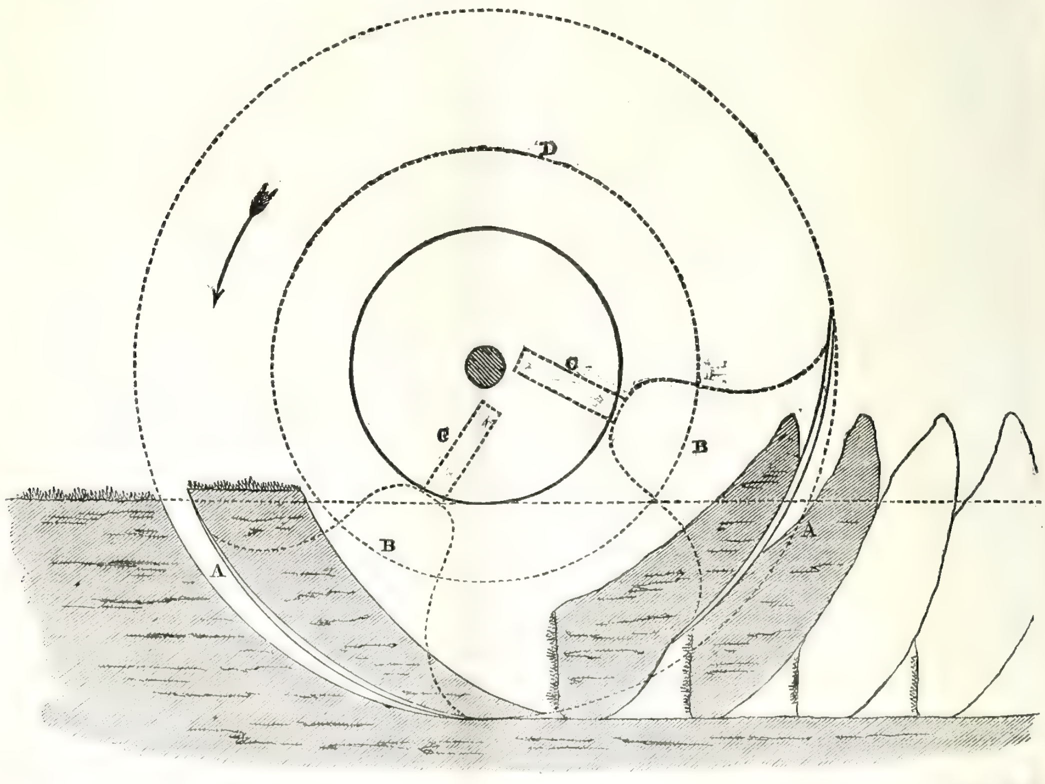
MACHINES ACTUATED INDEPENDENTLY OF TRACTION.

I dismiss without notice multitudinous contrivances for imitating the motions of manual digging, partly because they would demand more space than I feel at liberty to devote to them, and partly because I prefer, for simplicity and practicable character, machines having a continuous circular motion and few working parts; and indeed, I believe, that ultimately the highest order of results which steam-culture will ever attain, will be by a revolving tiller, because, theoretically, it is best adapted to the new motive-power.

The idea of Mr. Hoskyns, that a cylinder of claws, tines, or cutters, should be attached behind a locomotive engine, and driven at a more or less rapid speed by the motive-power, notwithstanding the success of steam-traction implements, never promised better than it does now. I do not know what has become of Mr. John Bethell's revolving forker, but, at any rate, Mr. Romaine's machine, in the hands of Mr. Alfred Crosskill, has, at

last, achieved considerable success, the velocity of the digger, however, being greatly moderated from that originally proposed. A rapidly revolving scratching tool may serve for superficial slicing and mincing as a substitute for paring; but in order to invert the soil completely, and perform the best kind of work required by the farmer in deep culture (for which digging machines seem most suited), I am of opinion that the soil must be cut or broken into pieces of sufficient bulk to be turned bodily upside down, and these must not be left to fall at hazard in any posture, but laid in their proper position by the machine, in order to make perfect work. This operation necessitates a slow rather than a quick rotation of the cutters; accordingly, Mr. Usher's rotary steam-plough, in which a series of curved plough bodies are attached about a horizontal axis driven by gear work, behind a locomotive engine, was a near approach to what we required, and had the tilling machinery been combined with a modification of the endless railway engine, or the difficulty of locomotion been otherwise better overcome, this invention would probably have given us a cheap, though not very perfect, order of tillage. But Mr. Romaine's cultivator is a decided success. A digging-cylinder, 6 feet wide, is attached behind a 12-horse engine, mounted on a pair of very large broad felloed wheels, with two steerage-wheels on castors in front. The machine is perfectly independent of horses for travelling from place to place over moderately level roads or arable fields, though its weight is 10 tons, and it will turn short round, or in an area of its own length. Parallel connecting-rods, like those coupling the wheels of a railway locomotive, are used for driving the digger with a speed of 40 to 50 revolutions per minute, allowing it to be readily raised or lowered while in motion. The cutters, fastened by bolts and screws upon the plate-iron cylinder, resemble scarifier paring-shares in form, and, as the engine slowly advances, slice and dig up the soil from either 3 or 4 inches to 10 inches deep, as required. Having seen the work done, I can bear witness that tenacious soil is thoroughly broken up and subdivided, the surface-stubble, &c., buried sufficiently well, and the subsoil largely upturned and intermingled with the top staple—in fact, the work has much the appearance of that of the digging-fork. The successive operations of ploughing, dragging, and harrowing strong land are equalled by a single course of this machine, and at a far cheaper rate, the amount of work done being from 4 to 7 acres a-day, according to the description of soil and depth of work, at an expense of 5s. or 6s., up to 9s. or 10s. per acre. The price, I believe, is about £800. It is a matter for experience to determine how far the weight may prove injuriously consolidating on stiff clays, and whether the farmer can keep in order so many wheels, running bearings, and working-parts. The cultivating cylinder, however, promises to become all that the farmer requires; only, for working on ground already ploughed or cultivated, on hilly fields, and on wet clay soils, I hope means will be found to actuate it by ropes from a shifting or stationary engine.

In searching out and studying all the proposals I can meet with for digging or deeply trenching, I have concluded that the simplest, easiest, and most practicable idea, is that which is shewn in the annexed woodcut. A cutting-blade attached by an arm or stem to a horizontal axis, and curved concentrically, or nearly so, with the circle it describes, which entering the soil



A A. Position of the Digging Blades on entering and on rising out of the soil, cutting a spit say 8 inches thick and 9 inches wide, with the trench 15 inches deep.
B B. The stems or arms supporting the blades. These are sharp at their edges, so as to act as coulters for severing the side of the spit from the whole ground. The blades are set diagonally across the plane of the circle they describe, so as not to track after each other; and are turned round in sockets, C C, when required to point the other way, for the return course.
D. Size of the wheel by which the digger is driven.

downwards, shall cut a curved spit of earth from the face of the semicircular trench formed by its action, and emerging upwards on the other side of the trench, leave the spit in an inverted position.

A number of these cutters are to be affixed by radial arms to the shaft, but in order that they may not impede the delivery of the pieces of soil from each other, I propose that they should be placed at an angle with the plane of the circle they describe, and let the machine advance at right angles to the direction of their revolution, the axis being longitudinal instead of transverse, just as in Hanson's potatoe digger, and Huckvale's turnip thinner. The digging-disc (supported and actuated in a way to be presently noticed,) proceeds sideways, as it were, along the trench, slicing off spits from the face or edge as a workman does with a spade, and carrying and leaving them on the opposite side inverted and turned end for end. The arm or bracket to which each cutting blade is attached acts as a coulter to divide the portion to be cut. Suppose the blades to be of 9 inches breadth, then one blade must enter the ground for every 9 inches travelled by the machine; and with six cutters following one another (somewhat after the manner of the knives in Gardner's turnip slicer) the revolutions per minute will be only 29, for a progression of 1½ miles per hour. The "bite" or thickness of the spit may be, say 7 inches, when the depth is a foot; thus, for a single digging disc, the extent of land dug would be at the rate of 1⅛ acres per day, but, of course, I propose to have several diggers on the same shaft. Working at less depth, the speed might be increased. For going 12 or even 15 inches deep, the disc need not be of greater diameter than say three, or at most four feet. And it is to be noted, that though of small diameter, as the digger works always in the trench, a spur-wheel of considerable size may be hung on the same shaft to drive it. I propose that the machine should traverse up and down the field, without turning at the ends, the digging disc always remaining in the trench and revolving the same way. The only change necessary is to point the cutting blades at a different angle when the machine is to travel the reverse way; and this is done by setting each arm or stem in a socket, and connecting the six arms so that they are turned round simultaneously. The blades are double edged, in order that they may be turned round so as to bring the arms into operation as coulters, whichever way the machine may be moving. But the form of cutter proposed is also adapted for revolving upon a transverse shaft or cylinder like Romaine's.

Motion may be communicated to the digging-wheel in several ways. It may be affixed to a locomotive engine. But I should prefer to drive it by an endless rope, supported upon friction-rollers, in connexion with a stationary engine, or an engine shifted along one end of the field,—a modification, in fact, of Mr. Atkins' and Messrs. Fisken's method. For a single digging-disc, perhaps there would not be too great a resistance to be driven by wheelwork from the travelling-wheels of the carriage-frame, on the principle of Hanson's potato-digger: the wheel having teeth or cogs upon its felloe to give it a firm hold of the ground, might travel along the bottom of the trench, and so partially operate also as a sub-pulverizer, breaking up the hard bottom, and, as the digging-disc is adapted to a pace of 2 miles per hour, horses might work it if required. I would suggest, however, that in case the bite and resistance thus obtained were found insufficient for very deep work, a couple of wire-ropes wound upon the drums of the machine, and fastened down at both ends of the field by shifting anchors, would cause the drums and connected gear-work to revolve by the simple advance of the machine; though this travelling windlass would involve considerable weight and complexity.

My description of this rotary digger is very general and devoid of details, the rather rude drawings accompanying this paper merely giving some idea of the circular cutting and inverting of a movement I advocate, and, in fact, it is not the particular form, but the distinctive principle of action involved, that I wish to bring before you.

In conclusion, let me hope that at least some of my suggestions with respect to working traction implements by steam-power, and the construction of new tillage machines, will prove useful to some gentlemen who may be practically grappling with the mechanical difficulties in the field, and that the principle I have introduced to your notice for deep-digging and perfectly inverting the soil, with the least possible waste of power in raising the cut pieces, will meet with your consideration and approval.

DISCUSSION.

The following letter has been received by the Secretary:—

SIR,—In the *Journal* of this Society for February, 1856,* are a few remarks, I then made, on the subject of ploughing, or land cultivation by steam-power. These impressions were arrived at, and forced upon my mind by the importance of the subject, and by frequently witnessing the various methods (ingenious and persevering) by which the desideratum was sought to be accomplished. I would now frankly have renounced my ideas, and cordially have congratulated any inventor who had, by this time, made the progress then hoped for, and which their great efforts have really deserved; but feeling, as I do, that so little improvement has been made in the art by any of the methods during these two years, I am more convinced we are not yet in the right path to the possession of an implement such as would generally supersede the good horse plough, and which the enterprising agriculturist would hail with pleasure and readily adopt. Sincerely feeling, as I do, how very ungenerous and hard it may seem to these energetic pioneers to dwell on their unrewarded efforts, I would gladly adopt any course of remarks or argument, which would avoid allusion to a failure, or touch a disappointed hope, and would, therefore, briefly state that from all I have yet seen or heard of improvements and trials of the now existing means, I am forced back to the conclusion I had arrived at in February, 1856, that the thorough and practical steam cultivator is to be wrought out of such a construction of machine as I then sketched. It may, with seeming justice be asked, why I disapprove of all existing plans, and still do not produce my own idea in a competitive form. My answer is, that during these years I have, through impaired health, been compelled to relinquish, in a great measure, the practical management of our somewhat large manufacturing business, and those left to do so find their heads and hands full enough in grappling with the large and small details of works requiring increasing attention.

The machine I had sketched in 1856, I still think well worth the consideration of one or more possessing the ability and bold determination of some of the gentlemen I have alluded to; and should success be theirs, I will be satisfied with that which is only due to me, for having pointed to the outline of an implement for so desirable an object. I would very shortly repeat, that the machine I proposed was in the form of a portable engine, not much exceeding in weight and size that now used to work a combined threshing machine; the addition and difference would consist in a frame containing a number of digging spades, and the application of the engine's power to the up and downward motion of the spades, and turning over the pieces of soil they lifted much in the same way as a man does with a spade. I think I may fearlessly assert that no plough has ever equalled the spade in beneficial results to the soil and its productions; the expense and insurmountable difficulty of having the work

* See Vol. IV., page 172.

done within the necessary time by men being the objections; and, if so, then the implement we really require is some twenty or more spades worked by the uncomplaining giant steam, so obedient and untiring. The arrangement of the spades, and their required motion are not insurmountable difficulties in the science of mechanics, while the engine's weight, instead of being a drawback as at present, would be the intermediate power by which I would force the spades into the ground, and these spades would act as so many levers, by which the machine would be moved step by step. No space, whether the field was large or small, would be left untilled any more than in the case of the best ploughing, and the digging would be deep or shallow at the option of the attendant, or as the frame had been set for him. No power would be misspent; the whole apparatus would be as free from derangement as the portable engine and threshing machine now are, and quite as portable; for when the work was done, the spade frame would either be lifted clear of the ground, or disengaged, and the travelling wheels left free for locomotion. In common with so many, I long to see an efficient machine for such a great work; and if my ideas should now fall into genial soil my object is served.—I am, &c.,

RICHARD GARRETT.

Leiston Works, Saxmundham.

The Chairman said this was a most important subject, for he thought that we were in a state of transition as regarded the cultivation of the soil. He had no doubt that, in process of time, the ingenuity of this and other countries combined would bring steam-ploughing, as well as reaping by machinery, into general use. More attention was required to the machine itself than to the engine which was to work it; the latter might be considered as having been brought almost to a state of perfection. He had an opportunity, at the Paris Exhibition, of witnessing the operations of from twelve to fifteen different steam reaping-machines, and he had reported upon them to the Government of this country. Throughout those experiments, it struck him very forcibly that more was wanted from the farmer than from the engineer, inasmuch as a great deal depended upon the land being brought into a state fit for the application of machinery. Until attention was paid by the farmer to this point, it was in vain for engineers and inventors to bring forward machinery for the cultivation of the soil. It appeared to him that, in good cultivation, the first step was to carry off the surplus water by a complete system of drainage, to increase the depth of the staple, and to bring to the surface portions of the subsoil. He believed, if those necessary preliminaries were carried out, they might apply machinery to the cultivation of the soil with good effect, and at a cost which would be within the means, not only of the gentleman-agriculturist, but also of the tenant-farmer. He saw many practical men present, and would be happy to hear their observations on this highly-interesting subject.

Mr. J. J. Mechi was of opinion that steam-cultivation would, ere long, become the custom of the country. He would mention that two years ago Mr. John Fowler ploughed a quantity of land for him, and he could assure them of the marked superiority of the crops on the land so treated, as compared with that subjected to the ordinary horse-ploughing. There was a difference in the crop of wheat, of at least a quarter per acre in favour of ploughing by steam. The superiority was apparent from the first appearance of the crop, and was maintained up to the time of harvest. The depth to which the land was ploughed was considerable, and, in addition to this, subsoil ploughing was also employed. The work was allowed, even by the labourers, to have been done with much greater regularity than could be effected by horse-ploughing, and fresh soil was brought to the surface which had never before been disturbed by any implement. It was true the work was done some little time before the crop was sown, and no doubt the action of the air upon the raw subsoil was very beneficial. He thought they would all agree as to the superiority of steam over horse-power, wherever it could be brought to bear. An acre of ploughing per day was considered fair horse work, and that would be done by 2 o'clock in the afternoon, at which time the horses returned to the stables, and remained there eating and sleeping till 6 o'clock the next morning. In the summer months especially, an immense amount of time was thus wasted, and the horses must be kept and fed whether they worked or not, so that all experience tended to show that horse-power in the cultivation of land was but a make-shift, and must, he thought, ultimately succumb to mechanical contrivances. His impression, some years ago, was that Romaine's engine would be very effective, and he had spent some £700 in experiments with that machine. Since then he believed £10,000 had been expended in experiments, and with very important results. He had no doubt larger sums yet must be spent before they arrived at perfection, and every year would witness large improvements in the application of steam machinery to the purposes of agriculture, as was the case with regard to manufactures. He hoped the farmers of the country would be sufficiently alive to the importance of adopting these appliances when they were offered to them. It was certainly not the duty of the tenant farmers to lay out their money in making these experiments, but at the same time they ought to be willing to pay a fair remuneration to those who afforded them the means of carrying on superior cultivation at a cheaper rate. By the facilities of inter-communication afforded by railways, many local prejudices had been abolished, and districts which formerly prided themselves that they were in the van in agricultural matters, discovered how much they were behind-hand. After all, depth of cultivation after good draining was the true manure. Let the subsoil be brought into contact with the air, and they would find a treasure which had never before been developed. He had every year increased the depth o cultivation on his land, and had always been rewarded for it. Recently he had a field dug all over with the steel digging fork, and he had found it more economical in its results than ploughing with horses. There were five horses ploughing in one field, and in another field four men fork-digging, and he found the latter cheaper at £2 per acre, the men earning 2s. 6d. per day, than the work of five horses and two men in ordinary ploughing. The more he saw of horse power the more convinced he was that it was the worst and most costly power that could be employed, but at present the use of it was unavoidable.

Mr. J. Allan Ransome said, that the very able paper they had heard was certainly a most accurate record of all that had been done in the application of steam machinery to agricultural purposes up to the present time, and many of the suggestions put forth, he felt, were extremely valuable. On the two previous occasions on which he had attended discussions on this subject, practical progress in this direction had been shown to be extremely limited. With the exception of a little work carried on in one season on Mr. Smith's farm, nothing had been practically done when the subject was first discussed in that room—at least so as to induce others to follow in the same steps. Since that time great improvements had taken place in the three leading plans referred to in this paper, namely, first the locomotive traction engine drawing an implement after it; secondly, the steam-engine employed to give motion to rotary machinery; and thirdly, the employment of traction ropes with a fixed engine. He had already expressed an opinion in favour of traction by means of stationary engines. His attention had been principally directed to the latter system, from the belief he entertained that the best practical results would be derived from it. Looking at the results of Fowler's method of steam-ploughing, it

had up to the present time been found very effective. This was shown by the fact of a 12-horse engine working five ploughs during the week, at the rate of an acre per hour. To accomplish the same work with horse-power, would take 16 horses. The number of men in the one case was five, and in the other eight; in the one case they must be all skilled ploughmen, whilst in the other they required only one person competent to drive an engine, another able to guide the ploughs, and the remainder could be done by boys. It was further to be remarked that, during the necessary period of rest and feeding both for men and horses, the steam-engine might be employed in other operations on the farm. He would now speak of another class of implements. The plough was universally admitted to be inferior to the spade. Why was that so? There must be some detrimental effects produced in ploughing which must be set against the good done to the land. In the first place, there was the treading of the horses' feet, and, in the next place, the hardening of the soil by the action of the broad bottom of the plough. He regarded the implement which had a tendency to break up and comminute the soil as the nearest approach to perfection; and where the steam plough had been introduced with the avoidance of friction, and where the soil was broken up by an implement following in the wake of the plough, he believed it was quite equal to the process of digging, and he thought this might be effected by the traction rope and fixed engine. At the same time, he thought that a lighter description of engine might be adopted which could be used as a rotary travelling engine. But whilst there was work sufficient for each manufacturer in his individual line, he thought ploughing by traction had been almost brought to perfection; but with regard to a thoroughly practical digging machine, he feared that the probability of success was rather remote. The necessary complication of such a machine would stand in the way of its success. He lamented as much as any one that the state of his friend Mr. Garrett's health had delayed his further progress in that direction, but his friends might console themselves that he had thus been released from a matter which would certainly have occasioned him a great deal of anxiety; and in the event of Mr. Garrett's restoration to health, he (Mr. Ransome) would advise him not to expend his energies upon the invention of a digging implement to be worked by steam.

Mr. J. J. MECHI mentioned, as a proof that Fowler's method of ploughing was coming largely into use, that a contract was taken for ploughing 200 acres by this plan on a farm in Essex. This showed that it was in large practical operation, and he had no doubt that it would answer.

Mr. NEWTON, although not a practical agriculturist, would venture to differ from some of the views expressed by Mr. Ransome. He did not think ploughing—taking the plough in the form in which they were acquainted with it—could be beneficially carried out to any great extent in this country by means of traction power. Whether the implement was capable of modification so as to obviate the hard under surface occasioned by the sole of the plough, he could not say. Every agriculturist would admit that ploughing was not so beneficial an operation in the preparation of the land as hand labour with the spade, but this was so expensive as to be out of the question. He thought the application of traction by ropes to the plough involved great waste of power, and the friction of the rope on the ground occasioned an amount of wear and tear which formed a serious item of expense. Nor was that the only objection to ploughing by steam under the method adopted by Mr. Fowler. There must be great waste of time, especially in small fields of six or seven acres, in arranging the anchors and windlass, and also in the lateral shifting on the headland. It was stated in the paper in some instances to occupy 25 per cent. of time throughout the whole of the day. That formed a serious item. If they had large fields, such as were seen on the Continent, the case might be different, and in fields of 100 or 150 acres, Mr. Fowler's plan could probably be carried out with advantage. They must, however, take the case as it stood in this country. They could not remodel estates.

Mr. MECHI said this *must* be done.

Mr. NEWTON very much questioned whether the landlords as a body would allow their tenants to grub up the hedges, and cut down the trees, to form open lands on their farms. Reference had been made to Romaine's cultivator. That machine could be taken to any field where the gateway was wide enough to admit it, and every foot of the land could be cultivated by it, without any further operation being required, besides which it was capable of being adapted to all the purposes for which the portable steam engine was employed upon a farm. The cost of that machine was stated in the paper to be £700. It ought, however, to be borne in mind, that an implement of that kind dispensed with a considerable amount of horse power. He believed it was not generally known that the horse power for agricultural purposes in this country consumed from one-fifth to one-sixth of the whole produce of the land.

Mr. MECHI said, on small and moderately cultivated farms it would amount to one-fourth. On well cultivated lands it would be about one-fifth.

Mr. NEWTON added that such an item in the expenditure on a farm was very serious. He repeated his belief that the system introduced by Romaine would ultimately be found to be most successful in the cultivation of the land, from the fact that all the necessary operations were effected at once.

Mr. MECHI wished to explain that in stating the consumption of the horses on a farm to be, in some cases, one-fourth of the produce, he did not mean one-fourth in value, as of course horses were not fed upon wheat, but the produce arising from one-fourth of the extent of the farm.

Mr. JOHN FOWLER had listened with great interest to the able paper of Mr. Clarke, which he regarded as a most excellent *résumé* of what had been effected in steam culture up to the present period, and an extremely fair criticism upon the merits of each invention. With reference to the remarks of Mr. Newton, although he agreed with him in the belief that rotary cultivation in some shape or other would be ultimately brought to bear, yet they could hardly assume that it would do all that was required. It was possible that rotary cultivation might effect the overturning of the soil, and he believed there was no very great difficulty in bringing it to bear for that purpose on level and firm soils, but upon very uneven surfaces the power expended in taking the machine over them must be very great. Of course there were many improvements in detail which might be made in such a machine, and he should be glad to see the gentlemen agriculturists of England—for it was not the place of the tenant farmers to do it—appropriating a small portion of the income which they derived from the land to experiments in rotary cultivation. With regard to himself, he ventured to say that the system of ploughing he had introduced was a step in the right direction. He thought there could be no question that it was a really practical plan, inasmuch as it performed the ploughing at half the cost of horse-power, and the work was better done. He was happy to have the testimony of Mr. Mechi in its favour, though it was by no means the first he had had. Seven acres of sandy soil, in the neighbourhood of Ipswich, had been ploughed by steam, and the result was, even on land which had no rich subsoil to be turned up, that a yield of a quarter per acre more in the crop was obtained. The people in the neighbourhood suggested that the difference arose from the depth of the tillage having prevented the drought from attacking the wheat. He admitted the superiority of hand-spade cul-

tivation over even steam ploughing, but it was too expensive in practice, and he was prepared to say that, on heavy clay land, steam-cultivation, equal to spade-labour, could be done for 12s. an acre. With regard to the wear and tear of the rope under his system a misapprehension existed. Upon clay land, he would guarantee the wear of the rope at sixpence per acre; he believed it would not exceed 3d. per acre; but if the work was done upon gravelly soil, abounding with sharp flint stones, greater care was necessary with regard to the rope, although in such cases he believed the expense would not be greater; but if farmers used the rope in the careless manner they frequently did their steam-engines, of course they must be content to bear the expense of their negligence. Judging of what he had seen of rotary cultivators, he believed that they would occupy a prominent position in a few years, and no pains should be spared to bring this about. There was one point which bore materially upon steam cultivation. The moment they were prepared to do all the cultivation on a farm by means of machinery more advantageously than by horse-power, horses themselves would only be required for the carting, and would have to stand idle a large portion of the week. This showed the importance of bringing about a perfect system of steam traction. Mr. Boydell had gone far to develop that. He (Mr. Fowler) believed that a smaller class of that description of engine—say of four-horse power—could be used for the work of a farm more economically than horses. He thought it ought to be fairly tried. Who was to try all those experiments? Were the inventors to bear the whole brunt of that which was in fact a national benefit? The landlords hitherto had done little. The Royal Agricultural Society had given no help. He could only state that the trial of his system at Salisbury was appointed to take place on a steep hill, resembling the roof a house, and the decision arrived at was that the steam plough would not answer. Notwithstanding all this, he was prepared to prove that he could plough at half the cost of horse power. It was plain they would get no assistance from the public or from the landed proprietors, who would, after all, derive the greatest benefits in the improved rental of their estates. As far as steam ploughing was concerned, he considered his task was done; but it was for such men as Messrs. Romaine and Boydell to carry their experiments further in another direction, and he was strongly of opinion that the public at large ought to help them in their work.

Mr. Smith (of Woolston) avowed his determination not to receive any assistance from any society or any individual. He would state his reasons for not using the combined plough for the inversion of the soil. In January, 1856,* he stated before this Society what he had done in the way of steam tillage up to that period, and he would now state what he had done further since that period. He would not speak of his own plough, but would refer to the machinery employed for laying out the land and the mode in which he effected it, as upon that he considered the success of his system of tillage mainly depended. In the two experiments referred to by Mr. Clarke in his paper, one at Chelmsford and the other at Woolston, he (Mr. Smith) had not space enough to show properly how he set out his work. Mr. Smith proceeded to explain the details of his plan, particularly describing the mode of setting out his machinery and tackle. (This, however, would be unintelligible without the plans and sketches to which he referred.) Mr. Smith went on to remark, with reference to steam culture, that all farmers would admit that the first month after harvest was worth all the other months of the year put together. There were, in fact, only two months which were really valuable to the farmer for ploughing. Those were September and October. The engine which he recommended was the common 8-horse engine, but he had found a 7-horse engine sufficient for all his work, upon a farm of about 200 acres, 110 of which were arable, and the engine could do all the threshing, grinding, cutting, &c. The tackle to be attached to it, he contended, was paid for in the first season it was used. He had found in his own experience and that of his brother farmers, that a quarter per acre more in the yield of the crops resulted from his system. Mr. Smith next proceeded to contrast the system of anchorage and rope traction adopted by Mr. Fowler with his own plan, and pointed out the important reduction he had made in the number of horses he had employed previously to the introduction of his system of steam-cultivation. In the first year he steam-ploughed a field twice over, and the yield was 41 bushels of peas per acre; the succeeding crop was barley, and the yield of that was 7 quarters 1 bushel per acre, from land which formerly only gave a yield of 5 quarters per acre. Upon an average he employed his steam machinery in culture 39 days in the year, consuming 14½ tons of coals, at a cost of £14 10s. The only additional cost was in increased labour, for during that period he had allowed his men sixpence a day extra. Mr. Smith then read letters from Mr. Randell, of Chadbury, near Evesham, Mr. Bright of Teddesley, Mr. J. Whiting of Stoke Goldington, and Mr. George Taylor of Mentmore, speaking of the successful working of Mr. Smith's system of steam-cultivation, on land in their occupation, or under their management.

The Chairman regretted that the time had arrived for closing this discussion, more especially as he saw present several other inventors—amongst them Mr. Halkett—from whom he had hoped to hear some observations on this highly important subject. They would, however, all agree that Mr. Clarke was entitled to their best thanks for his able paper.

A vote of thanks was then passed to Mr. Clarke.

On the table was exhibited a clock case, elaborately carved in box wood, designed and executed by Mr. W. Perry, of North Audley-street. The design represented an oak tree with various birds on the branches, and with wild flowers and a stream of water at its base.

The Secretary announced, that on Wednesday evening next, the 17th inst., a paper by Professor Crace Calvert, "On Recent Scientific Discoveries as applied to Arts and Manufactures," would be read.

EXAMINATIONS.

Mr. J. C. Macready, one of the Honorary Local Secretaries of the Society of Arts, recently gave a reading from the English Poets at the Town-hall, Poole. The *Poole and South-Western Herald* states that "the special object which this gentleman had in view was the raising of funds in order to enable the Poole Institutes to form classes in various branches of education (in conjunction with other Institutions in this part of the country), to be conducted in accordance with the rules, and in connexion with the Society of Arts; and the members to be admissible to the Society's Examination for prizes and honorary certificates."

HANTS AND WILTS ADULT EDUCATION SOCIETY.

This Society, which is in Union with the Society of Arts, was established in 1853, and its objects, as stated generally in the prospectus, are—1st, the establishment and assistance of Literary and Scientific Institutions, libraries, whether stationary or itinerating, reading-rooms, and evening schools; and 2ndly, the en-

* See *Journal* Vol. IV., p. 175.

couragement of a spirit of improvement either by the delivery of lectures, and the formation of classes; or by examinations, certificates, and prizes. Its operations include the counties of Hants and Wilts, with such other places as, by reason of contiguity, or for convenience sake, are accepted by the committee.

The honorary secretaries who have been especially instrumental in carrying out its objects are, the Hon. and Rev. Samuel Best, Mr. Wyndham S. Portal, and the Rev. Thomas Bacon. It was originally instituted merely as a Lecturers' Association for mutual assistance, and it afterwards undertook, by the aid of lecturers, to promote the establishment of libraries, reading-rooms, and evening schools, all its machinery having been brought to bear on the improvement of the adult population.

The members are 1st, annual subscribers of £1, or donors of £10; and 2ndly, lecturers who, their services having been accepted by the committee, have given or undertaken to give at least three lectures gratuitously, in the current year, to Institutions in Union with that Society, and without any compensation by mutual assistance. Members are entitled to admission to all lectures, and to the free use of diagrams, models, apparatus, &c., in any of the Institutions, or in their own houses. Subscribers of 10s. are entitled to admission to all lectures.

The committee have appointed, in different districts, honorary local secretaries, who materially assist in carrying out the objects of the Society.

The terms upon which Institutions and schools are admitted into union with the Hants and Wilts Society are as follows:—

Institutions in Union with the Society of Arts, if within the districts embraced in the operations of the Hants and Wilts Society, are entitled to free admission into union. Schools are admissible on payment of 5s. per annum, and any peculiar Institutions at the discretion of the committee. Ordinary Institutions and reading-rooms are taken into union on forwarding to the secretary an application to that effect from any member of the Institution who is also a member of the society.

There are at present about 90 Institutions and schools in Union with the Hants and Wilts Society.

It publishes annually a list of lectures offered gratuitously to the Institutions in its Union, and otherwise promotes this branch of adult instruction. In the autumn of 1855, at a meeting of the Society, held at Basingstoke, it was resolved to offer premiums for the encouragement of evening adult schools. The gratuities are given on the following conditions:—

"1. The gratuity offered by the Society must be doubled from local sources, independent of the class fees.

"2. No pupil under the age of 15 years shall be counted, with a view to the gratuity, unless employed in industrial occupations during the day.

"3. The amount of the gratuity will depend on the number of scholars who have attended not less than 80 hours, and on the number of hours the school has been open.

"4. Reading, writing, and arithmetic shall be deemed essential subjects of instruction. The knowledge of Scripture, geography, English history, and of any branch of science will be favourably considered and reported on.

"5. The Committee reserves the power of withholding the gratuity on the ground of insufficient merit, or of marking its sense of higher efficiency by increasing it.

"6. A gratuity, increasing according to the value of the Certificate, will be given to the master of the Adult Evening School in Union whose scholar is successful in any of the Society's Examinations.

"7. Applications must be made for the gratuity to the Society's Local Secretary before the 14th day of March."

The method that has been adopted of determining the amount of the gratuity, with a view to the assistance of the poorer localities, has been to allow 1s. for every scholar who has attended 80 hours, 6d. for every scholar who has attended above 60 hours but less than 80, and 3d. for every hour the school has been open.

The last report states that nine evening schools have received gratuities.

The Hants and Wilts Society has also suggested a plan for grouping together the libraries of a district, so as to form a Local Union, allowing of a mutual interchange of the books. This plan is carried out by the local secretary in each district, with the consent of the librarians, in the following manner:—

"The catalogues of the libraries in union are interchanged.

"A subscriber to any of the libraries in union is entitled to the use of the books in any other such library (except such as are not allowed to be taken out of the room), on sending the name of the book required to the librarian of his own library, on or before a certain day.

"Each librarian should collect and return at the end of the month the books received the preceding month, and forward a fresh list of those applied for. The carriage should be paid for out of the funds of the library receiving the books.

"No book is to be sent out that has not been six months in the library.

"No librarian is entitled to apply, on behalf of the subscribers to his library, for more than one volume for every ten volumes in the library he represents. Volumes not returned are counted as against the library applying, and a forfeit of 1d. per week is to be paid by the person detaining a volume over two months, through his librarian, to the library to which the book belongs."

The Society has had it in contemplation to promote the establishment of evening classes and schools under *itinerating* teachers, though this object has, as yet, been only very partially carried out.

The most important means, however, which the Society has employed for the furtherance of adult education, has been the establishment of examinations, which have now been in operation two years. These examinations are divided into four classes, the arrangements of the first two being for the present year as follows:—

"CLASS I.—*A.* An examination in any 3 lectures that have been delivered in the member's Institution within the last year. *B.* An examination in any subject taught in a class of which the candidate has been a member. *C.* In any 3 vols. on history, science, or geography, in the library of his Institution. *D.* In 3 subjects chosen by the Society, announced at each anniversary meeting. For 1858:—1. The History of England from 1377 to 1509. 2. The Hydraulic Ram and Press. 3. The Mountain System and River Drainage of Europe. *E.* In any three subjects or books chosen by the member and approved by the secretaries of the Society. 1st week in May.

"CLASS II.—*A.* A similar examination to that of a candidate pupil teacher. *B.* A similar examination to that of a pupil teacher at the end of the 1st year. *C.* A similar examination to that of a pupil teacher at the end of the 2nd year. *D.* A similar examination to that of a pupil teacher at the end of the 3rd year. *E.* A similar examination to that of a pupil teacher at the end of the 4th year. *F.* A similar examination to that of a pupil teacher at the end of the 5th year. *G.* A similar examination to that for a Queen's scholarship. *H.* A similar examination to that for a master or mistress. 1st week in May."

In these classes the Examinations are conducted by written papers, which are forwarded to the Institute of which the candidate is a member, and the papers are returned to the Examiners, with the answers, accompanied by a certificate, signed by one or more persons appointed by the president of the Institute to conduct the Examinations. This certificate is in the following form:—

"HANTS AND WILTS EDUCATION SOCIETY.

"Two hours are allowed for the annexed paper. The

answers are to be enclosed and sealed in the room were the Examination is held, and sent by post to

---

"This Paper is to be returned with the answers, accompanied by the following certificate:—

"I hereby certify that I have been present during the two hours allowed for this paper, and that the enclosed answers are the answers of ,
without any assistance whatever, from books, notes, or otherwise.

"(Signed) " "

The following are the principal conditions upon which, in the Hants and Wilts Society, candidates are admitted to examination:—

"1. Candidates must give early notice of their intentions to the Local Secretaries, or to the Secretaries of the Society, specifying their age, school, or Institute, and the class of examination they propose to undergo.

"2. Candidates must send in with the notice a testimonial, first, of good conduct; and secondly, of their fitness to undergo the examination they select, signed by the president and secretary, or two managers of their Institute or evening school.

"3. Candidates must be above fifteen years of age.

"4. The Examinations in class 1 are equally open to males and females. Those in class 2 are not open to pupil teachers, masters, or mistresses.

"5. Certificates will be given to all who pass the Examination satisfactorily; to which prizes of books, varying in value according to the value of the examination, will be added, where the examination has been of distinguished excellence.

"Class III. and Class IV. consist of the examinations of the Society of Arts and of delegates from the University of Oxford, and arrangements have been made by the Hants and Wilts Society to carry on preparatory examinations for both these classes. The Society is also prepared to give assistance towards the expenses of all those who hold the Society's certificates and are desirous of presenting themselves for examination in classes 3 or 4."

It will thus be seen that, while by means of the examinations in classes 1 and 2, the most elementary knowledge may obtain recognition, and the candidate be encouraged to further efforts, the Society affords facilities for those who desire to offer themselves as candidates at the examinations of the Society of Arts and of the University of Oxford, where more extended knowledge may be recognised and rewarded.

SOUTH KENSINGTON MUSEUM.

During the week ending 6th Feb., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 2,652; on Monday and Tuesday, free evenings, 2,171. On the three Students' days (admission to the public 6d.), 630; one Students' evening, Wednesday, 73. Total 5,526.

Home Correspondence.

EXAMINATIONS.—BRIGHTON MEETING.

Sir,—Observing in your report of the meeting at Brighton, on the 22nd ult., of a Provisional Committee of Institutions in Union with the Society of Arts to meet a deputation from that Society, with a view to the formation of a Local Board of Examiners for Institutions in this locality, that it was stated that no reply had been received from the invitation sent to the Hastings Mechanics' Institution, I beg to state that, from a letter received this morning from Mr. B. Phillips, of Brighton, I find the invitation was addressed to the Secretary of the Hastings Literary and Scientific Institution, and that, consequently, it never reached me. If it had, our Committee would, doubtless, have deputed some one to attend the meeting, as the principle of the Society's Examination meets their entire approbation.

I am, &c., JOHN BANKS,
Hon. Sec. Hastings Mechanics' Institution.

Hastings, February 8, 1858.

THE INK OF THE ANCIENTS.

Sir,—Looking over the paper of Mr. Underwood "On the History, &c., of Printing and Copying Inks," I observe that no mention occurs of a method supposed to be employed by the ancient Egyptians, for the preparation of their ink, described to me by the late Mr. Charles Hatchett, F.R.S., and, as the particulars may still have interest for the author of that paper and others, I venture thus late to trouble you with them.

Mr. Hatchett said it had only latterly been known to chemists that borax is a solvent to shellac, and that prior to the knowledge of this fact the constituents of the Egyptian ink had been a mystery. He then explained that by making a solution of shellac with borax, in water, and adding a suitable proportion of pure lampblack, an ink is producible which is indestructible by time or by chemical agents, and which, on drying, will present a polished surface, as with the ink found on the Egyptian papyri. I made such ink, and proved the correctness of Mr. Hatchett's formula, if not its identity with that of ancient Egypt.

I am, &c.,
JOSEPH ELLIS.

Brighton, Feb. 9, 1858.

Proceedings of Institutions.

Royston.—The general annual meeting of the Institute was held on Wednesday evening, 27th January, the Rev. R. Shaen in the chair. The secretary read the report, which states that a review of the past year exhibits signs of progress. The total income, including a balance in hand at the commencement, amounted to £107 3s. 7d. The total expenditure was £97 2s. 5d., leaving a balance now in the hands of the treasurer of £10 1s. 2d. The members and subscribers who were connected with the Institute during the whole or any portion of the past year, consisted of 11 Life Members, 6 Honorary Members, 213 Ordinary Members, and 64 persons who were admitted to the lectures by family or school tickets; giving a total of 294, an advance of 23 on the preceding year. Among the ordinary members, 92 belonged to the classes of mechanics, domestic servants, and young persons under 18 years of age; an increase of 35 on the previous year. Sixteen lectures and entertainments were given during the year:—1 by W. P. Hammond, jun., Esq., on "A Tour in Spain;" 2 by R. Hunt, Esq., F.R.S., on "Sermons in Stones" and "Books in the Running Brooks;" 2 by Geo. Dawson, M.A., on "De Foe" and "John Bunyan;" 1 by S. N. Davey, Esq., on "Thomas de Quincey;" 1 by the Rev. John B. Whiting, M.A., on "The Chinese Rebellion;" 1 by Messrs. Williams and Miss Bessie Williams, a Musical Entertainment; 1 by Messrs. T. W. Pickering, C. Dryden, Justyne, Richards, and Davis, an Elocutionary Entertainment; 2 by E. Wheeler, Esq., on "The Electric Telegraph;" 1 by the Rev. W. W. Harvey, B.D., on "Our Anglo-Indian Empire;" 1 by George Buckland, Esq., a Musical Entertainment, "What shall my Songs be to-night?" 1 by R. O'Hara, Esq., on "India;" 1 by Dr. J. C. Daniel, on "Sir Walter Raleigh;" 1 by the Rev. John B. Whiting M.A.—Indian Scenes, with Explanatory Remarks. O

these, six were gratuitous. During the past year 55 volumes were purchased and added to the library. Mr. Isaac Beale, the Librarian, states that the number of members making use of the library during the year was 128, and the total number of volumes issued was 3875. This is a considerable advance on the preceding year. 125 members subscribed to the Reading Room during the year; and the average number making use of the room each evening was rather more than 19. Chess and draughts have been provided for the use of the members of the reading room. Mr. John Fordham, Secretary of the Preliminary Savings Bank, states that the number of depositors was 259, and the amount deposited £154 3s., the average by each depositor being 11s. 6d. The amount drawn out was £56 0s. 3d. After the adoption of the report, the election of officers took place, the Right Hon. the Earl of Hardwicke being elected President. After passing several votes of thanks, the meeting separated.

WAREHAM.—An interesting and instructive lecture was delivered at the Town-hall in connection with the Mutual Improvement Society, on Friday evening, the 28th ult., by the Rev. Dr. Fletcher, of Wimborne, on "India," illustrated by maps and diagrams; W. H. Hatherley, Esq., in the chair. There was a good attendance, and every one seemed pleased. The musical friends of the Institution played some select pieces before and after the lecture.

WIRKSWORTH.—The fifth annual report of the Mechanics' Institution, presented to a general meeting of the members, held on Monday, the 28th day of December, 1857, when Mr. Cantrell, president of the Institution, occupied the chair, congratulates the members on the continued prosperity and success of the Institution. At the commencement of the year, the number of members was 126, and the committee have admitted during the present year five honorary life members, one honorary yearly member, and fifty-five ordinary members, making a gross total of 187. Against this the committee have to report the withdrawal of thirty-one from various causes, so that the number of members at this time is 156, showing an increase of 30 members during the year. During the year four lectures have been delivered gratuitously in connection with the institution, each of which was pecuniarily profitable to it. The following are the lectures:—"Poetry and the Poets of Derbyshire," by T. R. Potter, Esq.; "The Pendulum;" 1st—as a guage of Astronomical Time; 2nd—as a guage of Musical time; 3rd—as proving the oblate sphericity of the earth; and 4th—as determining (Foucauld's experiment) the earth's diurnal rotation, by the Rev. J. Edwards; "Chemistry; the non-metallic elements;" by the Rev. F. H. Brett; and "Greek, Roman, and English Comedy," by the Rev. J. Edwards. The library comprised a large number of volumes which were valueless for the purposes of the Institution, and the committee authorised the librarian to select therefrom such as were suitable, and dispose of the others. In consequence of this step, the library has been reduced in number, but is more available and suitable than heretofore. 99 volumes of new books have been obtained through various sources and added to the library. The present number of volumes belonging to the Institution is 829; and during the year no less than 1,077 volumes have been exchanged. The committee continued the evening school, established by their predecessors, and alluded to in the report for 1856, up to April last, under the superintendence of Mr. H. Marsden. It was then closed during the summer months, and re-opened early in October. The present number on the books as attending the classes is 33, and the average attendance is 18. The balance in the treasurer's hands is £21 10s. 7d. In consequence of the favourable results of the Festival of last year, the committee thought it desirable to hold one this year also. The president of the Institution again placed the disposal of his grounds at the service of the committee, and a horticultural exhibition was held, which proved successful.

MEETINGS FOR THE ENSUING WEEK.

TUES. Royal Inst., 3. Prof. Huxley, "On Animals and Plants compared physiologically."
Civil Engineers, 8. Mr. J. A. Longridge, M. Inst. C.E., and Mr. C. H. Brooks, "On Submerging Telegraphic Cables."
Pathological, 8.
Statistical, 8. Mr. Newmarch, "On the History of Prices in 1857."

WED. Society of Arts, 8. Prof. Crace Calvert, "On Recent Scientific Discoveries as applied to Arts and Manufactures."

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Philosophical Club, 5½.
Antiquaries, 8.
Chemical, 8. Mr. Mercer, "On Atomic Weights."
Linnæan, 8. I. Mr. Lubbock, "On the arrangement of the cutaneous muscles of the Larva of *Pygæra bucephala*." II. Mr. Macdonald, "On the probable metamorphosis of *Pedicularia* and other genera of *Gasteropoda*." III. Mr. Macdonald, "On the Anatomy of *Eurybia*."
Philological, 8.
Royal, 8½.

FRI. Geological, 1. Anniversary.
Royal Inst., 8½. Mr. E. Beckett Denison, "On some of the Improvements in Locks since 1851."

SAT. Asiatic, 2.
Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Delivered on December 14, 16, 18, 19, 21, 22, 23, 24, 26, 30, 31, 1857. *January* 1, 5, 11, 12, 18, 29, *and February* 2, 1858.

Parl. No.
5. Pauper Lunatics (Scotland)—Return.
7. Oxford University—Copies of Statutes and Ordinances.
10. Ecclesiastical Commission (Ireland)—Report and Account.
4. Banks—Return.
8. Articles of Food—Return.
18. Netley Hospital—Reports.
22. Land Transport Corps—Copy of Instructions.
12. Flogging (Navy)—Return.
17. Flogging (Army)—Return.
23. China (Military Auditor)—Copy of Instructions.
9. Charterhouse—Copy of Report.
14. Freight of Specie—Return.
15. Public Parks—Return.
24. Common Law (Judicial Business)—Copy of a Letter.
16. East India (Revenue)—Return.
21. River Thames—Copy of Mr. Gurney's Report.
19. Australian Postal Service—Copy of Contract, &c.
20. Police (Counties and Boroughs)—Reports.
11. East India (Public Works)—Return.
2. Bills—Medical Charities (Ireland).
5. ——— Public Health Act (1848) Amendment.
Army Purchase Commission—Report of the Rt. Hon. Edward Ellice, &c.
Liverpool Compass Committee—First and Second Reports to the Board of Trade.
Galway Town Election—Report of Commissioners.
Colonial and other Possessions—Statistical Tables, Part 2.
Engineers Watt and Park—Paper relative to the Imprisonment of, at Salerno.
East India (Despatch of Troops)—Correspondence.
Decimal Coinage Commissioners—Lord Overstone's Questions, with Answers.
Trade and Navigation (1856)—Annual Statement.
Australia (Discovery of Gold)—Further Papers.
East Indies (Mutinies)—Appendix (A) to further Papers (No. 5).

FIRST SESSION, 1857.

125. General Index to Sessional Papers 1852—1857.

SECOND SESSION, 1857.

281. Public Income and Expenditure—Account.
329. Parliamentary Voters—Abstract of Return.
335. Accidents on Railways, &c. (Ireland)—Abstract of Return.
77 (A 3). Poor Rates and Pauperism—Return (A).
277. Lunatic Asylums (Ireland)—Report of Commissioners.
305. British Guiana—Return.
49 (7). Drade and Navigation Accounts (30th Nov., 1857).
224, 260 (1). Hudson's Bay Company—Plans referred to in the Report.
269 (1). Contracts (Public Departments)—Index to Report.
77 (A 4). Poor Rates and Pauperism—Return (A).
126. Civil Services, &c.—Detailed Statement of the Estimates.
252 (2). Hop Duties—Index to Report.
77 (A 5). Poor Rates and Pauperism—Return (A).
334. Convicts and Misdemeanants (Ireland)—Abstract of Return.
292. Railways—Return.

Delivered on 6th February, 1858.

28. National Gallery and British Museum—Return.
9. Bill—East India Loan.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Feb.* 5, 1858.]

Dated 8th December, 1857.

3038. William Jones Ward, Chorlton-on-Medlock, Manchester—Improvements in dyeing and printing textile fabrics and materials, and in apparatus connected therewith.

Dated 15th January, 1858.

68. John Macintosh, Aberdeen—Improvements in apparatus for the manufacture of articles of confectionery.

Dated 19th January, 1858.

86. Vital De Tivoli, 67, Lower Thames-street—An improved omnibus.

Dated 20th January, 1858.

95. Robert Martin, Glasgow—Improvements in machinery or apparatus for effecting the shipping of minerals in tidal situations.
97. William Muir, Strangeways, Manchester—Improvements in stands for letter copying presses and other small machines.
99. John Dyson, Edwin Wilkinson Shirt, and Henry Shirt, Tinsley Works, near Sheffield—An improved construction of spring for resisting sudden and continuous pressure.
101. Richard Archibald Brooman, 166, Fleet-street—Improvements in the preservation of animal and vegetable substances. (A communication.)
103. William Conisbee, King-street, Queen-street, Southwark-bridge-road—Improvements in printing machines.

Dated 21st January, 1858.

105. James Henry Wheatley, 15, Jacob's Well, Barbican, City—Improvements in printing machines.
106. William White, Adelaide-street, South Shields—Improvements in machinery or apparatus for making moulds or matrices employed in casting metals.
107. Thomas Ivory, Edinburgh—Improvements in steam boilers.
109. James Murdoch, 7, Staple-inn—Improvements in breaks for railway and other carriages. (A communication.)
110. Peter Wilson, Samuel Northall, and Thomas James, Birmingham—Improvements in locks and latches.
111. Edward Rawlings, Birmingham, and John Briden, Aston-juxta-Birmingham—A new or improved method of working stamps used for stamping or raising metals, and other such like purposes.
112. Henry Smith, Brierley Hill Iron Works, Dudley—An improvement or improvements in the manufacture of iron hurdles and fencing.
113. John Staite Brown, Cirencester—Improvements in mills for grinding corn or other substances.
114. William Clark, 53, Chancery-lane—Improvements in lubricating apparatus. (A communication.)
115. Hyacinthe Hermagis, Paris—Improvements in stereoscopes.

Dated 22nd January, 1858.

116. William Matthew Raine, 34, Bucklersbury—Purifying and increasing the illuminating power of gas.
117. William Blackett Haigh and Joseph Cheetham, Oldham—Improvements in valves for steam-engines and in superheating the steam.
118. James Brown, Coventry—Certain improvements in looms.
119. James Brown, Coventry—Certain improvements in Jacquard machines.
120. William Basford, Longport, Staffordshire—Improvements in kilns or ovens for burning or firing bricks, tiles, pipes, and pottery or earthenware, and in the mode of charging the ovens or placing or setting the articles that are to be fired therein.
121. Alfred Sterry, Gorwydd Colliery, Swansea—Improvements in safety lamps.
122. William Weild, Manchester—Improvements in machinery for winding yarn or thread on to bobbins, spools, cards, or other similar surfaces.
123. Thomas Walton Mellor, Ashton-under-Lyne—An improved apparatus for measuring water and other fluids.

Dated 23rd January, 1858.

124. Nicolas Augustin Drouet, and Pierre Philippe Le Coq, Paris—Improvements in treating chloride of sodium for obtaining therefrom certain useful products.
126. John Samwells, Dunstable, Bedfordshire, and Charles Henry Jones and Christopher Pickard, Leeds—Improvements in blocking and shaping hats, bonnets, and other coverings for the head.
127. John Gordon, 3, Railway-place, Fenchurch street—Improvements in machinery or apparatus for pulping coffee.
128. James Johnston, Paisley—Improvements in bonnets, caps, and other coverings for the head.
129. Charles Burn, Blomfield-crescent, Westbourne-terrace, Paddington—Improvements in the manufacture of iron cables and chains, which improvements are applicable to the manufacture of gold and other chains.
130. Jonas Craven, Bradford, and Wignall Hey and Charles Worsnop, Manningham, near Bradford—Improvements in actuating rotary shuttle boxes of looms.
131. Elijah Slack, Glasgow—Improvements in the treatment or preservation of potatoes and other amylaceous vegetable substances.
132. Joseph James Welch and John Stewart Margetson, Cheapside—An improved expanding or folding travelling bag or wallet.
133. Jean Jacques Huber, 14, Boulevart Montmartre, Paris—Improvements in the construction of brooches, bracelets, pins, and other articles of jewelry.

Dated 25th January, 1858.

134. Arthur Wall, East India road, Poplar—An improved lubricator for the moving parts of machinery.
135. George Edward Dering, Lockleys, Hertfordshire—Improvements in the permanent way of railways.

Dated 26th January, 1858.

136. Jeremiah Garnett, Otley, and Peter Garnett, jun., Cleckheaton, Yorkshire—Improvements in the manufacture of felt.
138. Sir Henry Stracey, Bart., Blackheath-hall, Norfolk—An improved cartridge.
140. William Edward Newton, 66, Chancery-lane—A new or improved fabric intended principally as a substitute for leather. (A communication.)
142. Luigi Ferrari Corbelli, Florence, Tuscany—A new or improved process for obtaining aluminium. (Partly a communication.)

Dated 27th January, 1858.

146. Thomas Mottram, John Edwards, and Joseph Mitchell, Yorkshire—Rolling steel, iron, and other metals, and also for tilting the same for cutlery and other purposes.

WEEKLY LIST OF PATENTS SEALED.

February 5th.

2123. Daniel Jones Crossley.
2124. Ellis Rowland.
2127. John Parker.
2132. Thomas George Shaw.
2140. John Roberts, jun.
2157. Robert McAdam.
2180. John Abraham.
2235. François Jules Blanc.
2287. Lionel Gisborne and Henry Charles Forde.
2481. John Chubb.
2554. Athanase Victor Constant Regnauld.
2728. Johan Ernst Fridrich Luedeke.
2867. Alfred Vincent Newton.
2896. Philip Bettle.
2911. John Cope.
2984. Richard Hipkiss and William Olsen.
2987. Edward Clarence Shepard.
2996. Alexander Parkes and H. Parkes.
3103. James Broad.

February 9th.

2139. James Bertram and John Louis Jullion.
2143. Amherst Hawker Renton.
2144. Peter Augustin Godefroy.
2145. George Chambers.
2150. Thomas Hardcastle.
2151. Robert Wagstaff.
2152. Robert Wagstaff.
2153. William James Cantelo.
2170. Samuel Clift.
2177. John Buckley and Thomas Wrigley.
2197. Arthur Wall.
2198. Arthur Wall.
2205. William Hartley.
2263. James Goodwin and Andrew Boyd.
2271. Robert Aytoun.
2278. George Cumming.
2291. George Bell.
2325. William Edward Newton.
2333. William Sellers.
2395. Thomas Sidebottom Adshead and John Platt.
2413. Hugh Greaves.
2443. Pierre François Joly.
2485. Richard Watson.
2519. James Ward.
2737. William Clark.
2761. John Lawson.
2876. Thomas Richardson.
2893. Adolphe Ambroise Salomon-Cohen.
2491. Augustus Frederick Butler.
2966. Robert Tindall, junr.
3073. Joseph Parker.

Patents on which the Stamp Duty of £50 has been Paid.

February 1st.

258. Edmund Clegg and James Leach.

February 3rd.

263. Godfrey Pattison.

February 4th.

265. John Henry Johnson.
286. William Warbrick and J. Walker.
320. Auguste Edouard Loradoux Bellford.

February 5th.

301. George Fergusson Wilson and George Payne.
316. George Hallen Cottam and Henry Richard Cottam.

February 6th.

302. Frederick Ransome.
331. Auguste Vallery.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4051	Feb. 4.	Improved Configuration of a Drum	Rudall, Rose, Carte and Co.	20, Charing-cross.
4052	„ 6.	The Paragon Shirt	H. F. Lawes	Bristol.
4053	„ 8.	Royal Princess Corset Fastener	The Edinburgh Machine Sewing Company	Edinburgh.
4054	„ 8.	Churn Driving Apparatus and Stand	Thewlis and Griffith	Warrington.
4055	„ 8.	An Improved Piston for Valved Musical Instruments	Joseph Pimlott Oates	Erdington.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 19, 1858.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of *recent* Inventions.

Persons intending to contribute to the Exhibition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.
2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATION PRIZE FUND FOR 1858.

The following additions have been made since the last announcement :—

John Ames	£5	5
William Hawksworth..................	1	1
James Holmes..........................	1	1
William T. Radford	1	1

COMMITTEE ON THE PATENT LAWS.

The Council have re-appointed the Patent Law Committee of 1856, and the following gentlemen, who formed the Committee at that time, have been requested to serve again :—

W. Bridges Adams.
John George Appold, F.R.S.
W. G. Armstrong, F.R.S.
Samuel Holden Blackwell.
J. M. Blashfield.
John Braithwaite.
Jacob Brett.
Joseph Burch.
F. Crace Calvert.
Dugald Campbell.
Robert Lucas Chance.
Edwin Clark.
Henry Cole, C.B.
Charles Cowan, M.P.
Frank Crossley, M.P.
Thomas De la Rue.
Bryan Donkin.
William Ewart, M.P.
William Fairbairn, F.R.S.
Robert Fletcher.
Benjamin Fothergill.
Sir Charles Fox.
Dr. J. H. Gilbert.
Joseph Glynn, F.R.S.
Prof. Graham, F.R.S.
Peter Graham.
Warren S. Hale.
Henry Hensman.
John Hick.
Edward Highton.
A. C. Hobbs.
S. C. Homersham.
A. H. Houldsworth.
William Hutt, M.P.
Capt. L. L. Boscawen Ibbetson, F.R.S.
Owen Jones.
John Bennet Lawes, F.R.S.
George Lowe, F.R.S.
Sir John Macneill, F.R.S.
Henry Maudslay.
Charles May.
Henry Medlock.
J. E. McConnell.
John Joseph Mechi.
Herbert Minton.
Robert S. Newall.
Thomas Page.
Sir Joseph Paxton, M.P.
John Penn.
Ainger M. Perkins.
Richard Roberts.
Titus Salt.
Charles W. Siemens.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
Colonel Sykes, F.R.S.
J. P. Brown Westhead.
Prof. Wheatstone, F.R.S.
Joseph Whitworth.
George Fergusson Wilson, F.R.S.
Edward Woods.
Matthew Digby Wyatt.
T. H. Wyatt.

SOULAGES COLLECTION.

The Council have appointed a Deputation to join with the Institute of British Architects, and wait upon Lord Palmerston and the Chancellor of the Exchequer, to urge upon the Government the propriety of securing the Soulages Collection for Public Instruction. The Members named as the Deputation are the following :—

Beriah Botfield, M.P.
Dominic Colnaghi.
William Cubitt, M.P.
Warren De la Rue, F.R.S.
Henry Drummond, M.P.
William Ewart, M.P.
Viscount Goderich, M.P.
George Godwin, F.R.S.
F. Seymour Haden.
Henry Thomas Hope.
Owen Jones.
Joseph Locke, M.P.
George Moffat, M.P.
J. A. Nicholay.
Sir John Pakington, Bart., M.P.
Sir Joseph Paxton, M.P.
William Roupell, M.P.
Sydney Smirke.
J. Jobson Smith.
Lord Stanley, M.P.
William Tite, M.P.
Matthew Uzielli.
John Webb.
James Whatman, M.P.
Thomas Winkworth.
M. Digby Wyatt.

Together with the Presidents of Institutions in the manufacturing districts.

EXAMINATIONS.

The following letters relating to the Examinations are published, with notes of the replies, for

the information of those who may be desirous to receive explanations on the various points raised by the writers :—

Berkhamsted, Feb. 5, 1858.

Sir,—In reply to your letter of the 30th ult., in which you desire to know what arrangement we have made in regard to the Society's Examinations, I beg to say that a Local Board has been formed, and several candidates have presented themselves, but the Board are of opinion that they are not (1) sufficiently advanced to bear the Society's Examination this year, but they give promise of being able to do so next year.

I am, &c.,
HENRY NASH, Hon. Sec.

Mechanics' Institute, Bradford, Yorkshire, Feb. 6th, 1858.

Dear Sir,—In connexion with the (2) Yorkshire Union we have made Bradford a local centre for this district, and have taken steps to form a Local Board of Examiners. Should any difficulty present itself, we shall be very glad to avail ourselves of your advice and assistance.

I am, &c.,
M. H. WALLS, Secretary.

P. Le Neve Foster, Esq.

75, Lansdowne-place, Brighton, Feb. 3rd, 1858.

Sir,—A committee has been appointed in Brighton, for the purpose of forming a Local Board of Examiners in connexion with the Society of Arts; can you, therefore, kindly inform me how many and what (3) Societies in Brighton are actually in union with your Society?

I am, &c.,
BARCLAY PHILLIPS, Acting Sec., *pro tem.*

P. Le Neve Foster, Esq.

Bristol Athenæum, 26th Jan., 1858.

Dear Sir,—Please inform me how you interpret clause 16 of the Examination programme (4). Does it mean that the candidates must be members or students in a class connected with the Institution, or that they must be either students in such a class, or members of the Institution; in other words, are members of the Athenæum, or other Institutions, eligible to compete, if not students of any class connected with it also? This is rather important to us, as many of the probable candidates are not now studying with either of our classes.

Can you supply me with some more copies of your last published programme (5), or can we purchase them of the publisher, if so, what would they cost us per 100? Please favour me with replies per return, for on Thursday I have a meeting of the committee, and should like to show them a copy of the announcement which will appear in the Saturday papers. At the same time, pray also favour me with any information (6) as to the number of firms who have agreed to accept, preferably, certificated applicants for situations, the arrangements for prizes this year, and other inducements to competitors (7) which we may embody in our advertisements, and thus, as far as possible, forestal and avert the trouble of reading and answering repeated questions from me.

I am, &c.,
J. W. DANIEL.

If we have lady applicants (as will probably be the case) from our Ladies' Classes, are we to examine them or no? (8).

Working Man's College, Halifax, Feb. 5th, 1858.

Dear Sir,—In answer to your inquiries of the 4th inst., I beg to inform you that we have made every arrangement for giving the members of this Institution the advantage of admission to the previous and final examinations described in the programme which has been sent us by the Council of the Society of Arts.

Our previous Examination, and also the Examination in the special subjects, will take place in the last week in February, and on the 26th we propose to send a list of the candidates for examination to the Council, as required (9). We have established a most efficient Local Board. We have no fear that it will be unable to carry out the intentions of the Council of the Society of Arts, but, at the same time, I must add, that it is the unanimous opinion of the managers of this Institution, that the final examinations will fail in their object, unless they are conducted in the presence of an examiner (10) sent down by the Society of Arts.

I am, &c.,
C. R. HOLMES.

The Secretary of the Society of Arts.

Institutional Association of Lancashire and Cheshire, Central Committee, Manchester, 1, Market-place, 9th Jan., 1858.

Dear Sir,—Our Council has just had its usual monthly meeting, and has instructed me to say, in reply to your three queries of the 4th inst. 1. The Examinations will be held at Preston and Manchester. 2. None, excepting Liverpool, which would probably form a good Local Board. 3. We do not know of any difficulties to be removed by either your Council or ours.

I can only repeat the desire of our Council to work in harmony with yours.—I am &c.,

DAVID MORRIS, Hon. Sec.

P. Le Neve Foster, Esq., London.

Liverpool Institute, February 10, 1858.

Dear Sir,—I have delayed answering your note of the 5th inst., until I received a reply from a body of gentlemen whom the Directors had previously asked to act as our Local Board of Examiners.

I have now the pleasure to inform you, that the Professors of the Queen's College, which, as you are aware, is associated with the Institute, have consented to form a Board of Examiners for this Institute, and such of the neighbouring Institutes as may choose to take advantage of the arrangement.

These gentlemen are :—The Rev. Henry Griffiths, the College Professor of Logic and Ethics; Donald Cameron, Esq., M.A., Professor of Greek and Latin, and Grecian and Roman History; James Elliot, Esq., Professor of Mathematics and Natural Philosophy; Rev. James Cranbrook, Professor of the English Language and Literature; M. Husson, Professor of French; Dr. Carl Retslag, Professor of German; Rev. D. M. Isaacs, Professor of Hebrew; George Hamilton, Esq., F.C.S., &c., Professor of Chemistry; Isaac Byerly, Esq., F.R.C.S., F.L.S., Professor of Physiology; T. C. Archer, Esq., Professor of Botany.

With reference to the kind offer expressed in your letter of aid to surmount any difficulties we might experience, I have only to thank you for it.

That letter and your Programme are so full and so clear as to leave nothing to be desired in the way of information, except on points of minor importance, not to be called difficulties, such as, who, in Institutes constituted like ours, come within the meaning of the term "member," as used in paragraph 16; and such also as is referred to in the Programme, to secure as nearly as possible uniformity (11) of value in the "passes."

The Programme seems to me to contain unanswerable replies to every doubt that might be advanced respecting the superior merits of this scheme, as compared with that of last year. It cannot be denied that *vivâ voce* examinations afford valuable tests, which are wanting in examinations by papers; but, I believe, it is equally unquestionable that this year's plan will far more nearly approach the accomplishment of the Society's object in instituting the Examinations than would have been at all possible under the former scheme, the operations of which could never have extended beyond very narrow limits.

On reading the Programme, I was much surprised by its complete adaptation to its purpose. This could scarcely have been accomplished without very much thought and labour. Possible practical difficulties, such as almost always reveal themselves in the working out of any scheme, must have been well considered before a

plan could have been produced so free from them, as I feel sure this will prove to be, so simple in its machinery, and yet so calculated to suit all the numerous and various conditions to which it is intended to be applied.

Of course, the standard and subjects of the examinations will scarcely be what each Institute would have desired, and they will doubtless be varied as experience may suggest; but, in the present circumstances, they are the best arrangements which, in my opinion, could have been made. The Society richly deserves the best thanks of the Institutes for its labours in this matter.

I should state that Dr. Hume, your Honorary Local Secretary for Liverpool, lately delivered a very able, interesting, and encouraging address to our students, in reference to the plan of Examinations. It was given at our annual meeting; and an abstract of it, if not the whole, will be printed with our annual report, a copy of which I will shortly send to you.

* * * * *

I am, &c.,
ASTRUP CARISS, Secretary.

P. Le Neve Foster, Esq.

Mechanics' Institution, Louth, 4th Feb., 1858.

Dear Sir,—The committee have appointed five of their members the Local Board of Examiners for the Society's Examinations. It would be impossible to select five others more qualified for the office than those gentlemen they have selected. Two of them are principals of large educational establishments, one is a barrister, one is a surgeon, and the other is the President of the Institution, a Dissenting Minister; both of the latter are distinguished by their great scientific attainments. We have published a small handbill, in order to make the Examinations generally known, a copy of which shall be sent you.

Will you be good enough to send me five copies of the programme for the Local Board.—I am, &c.,

B. CROW, Hon. Sec.

P. Le Neve Foster, Esq.

Mechanics' Institute, Northowram, Halifax, Feb. 11, 1858.

Dear Sir,—I am duly in receipt of your circular letter of the 8th instant, and brought the subject of the Examinations, together with your letter, before the monthly meeting of the directors of this Institution last evening.

We shall be able to present for examination by the Society's Examiners, at least, one member of this Institution, who will be willing to undergo an examination in arithmetic, algebra, mensuration, and bookkeeping. As our Institution lies at a distance from any other one, and the directors are of opinion that there are gentlemen in the neighbourhood competent to undertake the duties of Examiners, they have decided to form a Local Board of their own, to consist of the following gentlemen:—William Moore, Esq., The Rev. W. H. Wawn, M. A., and Mr. Michael Washington; and I shall be happy, until further arrangements are made, to form the means of communication between these gentlemen and yourself. The Local Board will be prepared to conduct the previous Examination in Easter week, and to superintend the final examinations during Whitsuntide. In the meantime they will feel obliged if you will keep them informed of any proceedings of the Council in reference to these Examinations, and will be grateful for any suggestions with which you may favour them.

Has not geography (12) been recently added to the subjects in which the candidates are to undergo a previous examination, and is it not a subject in which much difference of opinion may exist as to what will be sufficient to enable a candidate to pass?

I shall esteem it a favour if you would give me your opinion as to what is intended to be the nature of the Examination in this subject.—I am, &c.,

JOHN W. WOOD, Hon. Sec.

P. Le Neve Foster, Esq., Society of Arts.

Gibson-street, Newcastle-on-Tyne, Jan. 15, 1858.

Sir,—In reply to your queries of the 4th January, I have to state, in reference thereto, 1. At Newcastle, as the most central place in the four northern counties.

2. I do not think you can, because there are very few classes connected with the Institutions. Classes are generally conducted by private teachers as night schools.

3. I do not think you can. The Societies in the North are not educational so far as classes are concerned, nor have they any accommodation for making them so. The returns to us from 55 Institutions, show that there were only 16 classes, and the total number of pupils entered 263, and the attendance of these not satisfactory. The classes best attended are French and German, because, in seaport towns, a knowledge of these languages is necessary to procure situations of trust in merchants' offices, and then the persons who attend these classes are not mechanics or the working classes.

The classes in the North of England Societies are not in a satisfactory condition, and where they do exist they are by no means in a flourishing state, and hence I imagine that you can be of little use.

I am, &c.,
J. D. THORNTON, Hon. Sec. Northern Association of Literary and Mechanics' Institutions.

Meyrick-street, Pembroke Dock, 11th Feb., 1858.

Sir,—Having been appointed a member of the Local Board of Examiners for this Institute, I am requested by my colleagues to make some inquiries for our guidance. It is stated that the previous examination shall take place twelve weeks before Whitsuntide. Cannot this requirement be a little relaxed? (13) In the letter received by the Secretary of the Institute this week, geography is named as one of the preliminary subjects, although it is not named as one in the programme. (14) It is also stated in that letter that the previous Examination is to be partly *vivâ voce*. Is that necessary, or is it optional? (15) The most important points, however, are the nature of the questions to be set—the amount of difficulty they should involve—the mode of determining the value of the solutions (16) and the standard to be reached in order to secure a "pass."

We shall be most happy to receive all the information you can give us on these points. In my own opinion the nature of the questions, the marks awarded, and the standard to be reached should, if possible, be uniform throughout the country.

In the next place we require to be informed to what extent the *special subjects* (17) should be examined in at the previous Examination?

Candidates are also asking such questions as these:—May they take one special subject; or must they take three? Is Mathematics considered as one special subject, or is each subdivision a special subject? If Mathematics be regarded as one subject, must all the subdivisions be taken up? May they take up Roman History without the Latin Language? (18)

Be so kind as to reply to the above as early as convenient, and to give us any other information likely to be useful.

Can you also supply us with a few copies of the programme for the use of the Examiners, and also for distribution?

I am, &c.,
JOHN T. COCK.

P. Le Neve Foster, Esq.

Pembroke Dock Mechanics' Institute, 11th Feb., 1858.

Sir,—We have chosen three persons as Examiners, two of them being schoolmasters; there are several members who have expressed themselves desirous of undergoing an examination, but there are a few questions I am desired to ask.

It is stated in the programme or pamphlet we have received that a person will not be examined in *more* than three subjects. Can he take up less?

Again, in taking up one subject, will the examination include questions in all the *subdivisions* of the subject, as in Mathematics; can the candidate select *one* of its subdivisions, as Algebra, or must he be prepared *in all*, including Conic Sections, Mensuration, Trigonometry, and Geometry?

Again, in Latin and Roman History, can one take up the Roman History without the Latin, and so on with the other subjects? You say that the previous Examination will be by papers and *vivâ voce*. Are these papers received from you or prepared by the Local Board themselves? (19)

Would you be kind enough, with your answer, to enclose two or three of the pamphlets relative to this subject?

I am, &c.,

A. W. NIELE, Secretary.

London Mechanics' Institution, Southampton-buildings, 4th Feb., 1858.

Sir,—In reply to your communication of the 15th January, on the formation of Local Boards of Examiners, I am directed by the Committee of Managers of this Institution to inform you that they are prepared to form a Local Board of Examination for our own members, and for those of other Institutions who may be willing to join them.

I am, &c.,

ANDREW M'FARLANE, Secretary.

P. Le Neve Foster, Esq.

London Domestic Mission Reading-room, Chapel-street, Cripplegate, Feb. 2, 1858.

Sir,—In reply to your circular on the subject of Local Boards, I am to inform you that it is the intention to form a Board of Examiners at this place, for the benefit of such of our members as may be willing and able to attend the next examination of the Society of Arts.

I am, &c.,

M. WADE, Hon. Sec. Reading-room.

P. Le Neve Foster, Esq.

People's College, Sheffield, Feb. 2, 1858.

Dear Sir,—I beg to inform you that the General Committee for the Examinations in Sheffield have formed a Board of Examiners, consisting of the following gentlemen:—The Rev. E. Ward, the Rev. E. Sandford, and Dr. Elam. If you have any communication to make to them with regard to the Examination, I should be happy to forward any letters you may send, as I think it necessary they should be in direct communication with you.

I remain, &c.,

THOS. ROWBOTHAM, Sec. to the Committee.

P. Le Neve Foster, Esq.

Sheffield Mechanics' Institution, Feb. 10, 1858.

Dear Sir,—In reply to yours of yesterday, our arrangements are all made; Local Committee and Examiners appointed. The Secretary is Mr. Thomas Rowbotham, of the People's College, from whom you will, no doubt, shortly hear.

I am, &c.,

HY. WOSTENHOLM.

P. Le Neve Foster, Esq.

Notes of Replies to the foregoing Letters.

Berkhampstead.

1. Though none of the candidates may be sufficiently advanced to bear the Society's Final Examinations this year, it is expedient that as many as possible, if not all of them should undergo the Previous Examination of the Local Board. This will be, for all parties, a good preparation for the next year.

Bradford.

2. The Committee of the Yorkshire Union have announced that arrangements are made for Local Boards to hold Examinations at Leeds, Bradford, Hull, York, Selby, Halifax, Middlesborough, Sheffield, and Wakefield.

Brighton.

3. The Institutions at Brighton in union with the Society of Arts are the following:—

Athenæum and Young Men's Literary Union.
London, Brighton, and South Coast Railway Literary and Scientific Institution.
Mechanics' Institution.
Royal Literary and Scientific Institution.

The Local Board includes representatives of all those Institutions.

Bristol.

4. Candidates for admission to the final Examinations may be either members of an Institution in union with this Society, or members of a class belonging to such an Institution. Members of an Athenæum in union are admissible to the Examiners without being members of a class in the Athenæum.

Copies of the programme may be had on application to the Secretary, Society of Arts, Adelphi, London, W.C.

6. The Declaration, signed by employers of labour in favour of candidates for employment who are certificated by this Society, may also be had on application to the Secretary.

7. The list of prizes, &c., for 1858, will shortly be published and distributed to the Institutions.

8. The Examinations are not limited to one sex.

Halifax.

9. The previous Examinations must be held by the Local Boards in time to allow the results to be communicated to the Council five weeks before Whitsuntide.

10. The final Examinations cannot possibly be conducted in the presence of an Examiner sent down by the Society of Arts. The Council have already received information of the intention to hold Examinations at more than 30 places, and the number increases daily. What is required at each place of final Examination is, not an Examiner—for the setting of the papers of questions, and the passing of judgment on the written replies, will be entirely done at the Adelphi—but the presence of two or three persons possessing the confidence of the Institutions, and authorized by them to superintend the working of the papers. These superintendants need not be persons of literary or scientific celebrity. They must be above suspicion of partiality. They will have to certify to the Council that they have been present throughout the Examinations, and have seen that the replies to the printed questions were written by the candidates without copying or prompting, or the use of books or notes, or any other assistance. These are simple duties, but they must be discharged with fidelity and firmness. If in any case the local authorities are not satisfied that they can get these duties discharged without external assistance, they will do well to seek the co-operation of some person or persons (of whom there are many) who are accustomed to such Examinations. The Council cannot assist the Local Boards to procure the services of such persons, because the Council, through their Central Board of Examiners, are the final judges in the competition, and, therefore, cannot take part in the local arrangements. If, however, the local authorities, in any case, having selected the superintendants of their Examinations, should desire them to call at the Society's House for such explanations of their duties as can be given to them, the Council will readily afford all the information in their power. It must, however, never be forgotten that the object to be kept in view in these arrangements is, not to establish a highly centralized system, but to develop the growth of local energies and local authority in education.

Liverpool.

11. When the Examinations of this year are concluded, the Council will enter into unreserved communications with the Local Boards, and will point out those cases in which the "pass" may appear to have been given with too much facility.

Northowram.

12. See note 14.

Pembroke Dock.

13. See note 9.

14. Geography is a special subject in the Programme. A previous examination in geography is required in those cases alone in which the candidate takes up geography as a special subject.

15. The previous Examination must obviously be oral in "reading," and written in "writing." Beyond these all is left to the discretion of the Local Boards. They may use written or oral tests in any proportion that they judge best.

16. The Council do not wish to prescribe uniform and positive rules on these points. Any inequalities in the value of the "passes" can best be corrected when the Examinations have been held, or when it has been seen what the different Boards have done, and with what results. The Council, however, will be most happy to give at any time any advice or explanations which any Local Board or individual member of it may desire.

17. All that is necessary is that the Local Board should satisfy itself that the candidate has a fair knowledge of the special subject. The Local Board, at the previous Examination, need not exactly guage the attainments of the candidates. It is, however, desirable that this should be done wherever it is possible. It is desirable that the Local Boards should have a real substantive character; should pass definite judgments on their candidates, and award certificates and prizes. It is desired that they should have a real authority of their own, and should rather co-operate as substantive bodies with the Society of Arts than merely as accessaries to the Central Board.

18. Candidates may be examined at the previous Examination in any subjects, and to any extent, that the Local Boards may determine. Candidates may be examined at the Final Examinations in any of the subdivisions of any one, two, or three of the twelve principal subjects of the programme. In Mathematics there are eight separately specified subdivisions of the principal subject. Candidates may take up the whole, or any subdivision, of any three subjects. Candidates may take up Roman History with or without Latin.

19. If the Local Boards generally should desire the Council to furnish them with printed papers for the previous Examinations, the Council will be happy to do so next year.

ELEVENTH ORDINARY MEETING.

Wednesday, Feb. 17, 1858.

The Eleventh Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 17th inst., William Odling, Esq., M.D., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Abernethy, James	Fleming, Thomas
Cawley, Charles Edward	Howard, James
Figgins, James, jun.	Ripley, Henry William

Spencer, John Frederick.

The Paper read was:—

ON RECENT SCIENTIFIC DISCOVERIES AS APPLIED TO ARTS AND MANUFACTURES.

By Mr. Crace Calvert.

On Colour obtained from Coal Tar Products.

When, in November 1854, I had the honour to read before this Society a paper on the products obtained from coal, I stated that ere long, besides carbo-azotic acid, some valuable dyeing substances would be prepared from this mineral. This expectation has been fulfilled. Messrs. W. Perkins and A. H. Church have obtained several blue colouring substances from the alkaloids of coal tar, and one from naphtaline, named by them Nitroso-phenyline and Nitroso-naphthyline, &c.

Mr. Perkins has lately taken a patent for the commercial application of some of these beautiful purple blue colours, which he has succeeded in fixing on silk, a sample of which I have the pleasure to lay before you. This fine colour, which rivals the delicate and admired colour of orchil, has this great advantage over it, that it is not destroyed by light; Mr. Perkins has, therefore, solved one of the problems of the art of dyeing, viz., the production of a fast colour similar to the fugitive one of orchil. Mr. Perkins's process consists in dissolving in water the sulphates of aniline, of cuminine, and of toluidine, and adding a quantity of bicromate of potash sufficient to neutralize the sulphuric acid in these sulphates. The whole is left to stand for twelve hours, when a brown substance is precipitated, which is washed with coal tar naphtha, and then dissolved in methylated spirits. This solution, with the addition of a little tartaric or oxalic acid, forms the dyeing liquor of Mr. Perkins.

Mr. Charles Lowe and myself have lately been fortunate enough to obtain from coal tar, products having a most extraordinary dyeing power, and yielding colours nearly as beautiful as safflower pinks and cochineal crimsons; and what increases the interest of this coal tar product is, that by the process we have discovered, we can obtain with it, on a piece of calico mordanted for madder colours, all the various colours and shades given by this valuable root—violet, purple, chocolate, pink, and red. The only thing which has prevented us from introducing into the market the crown red inodorous paper which we prepare, has been, that it is as yet too expensive to compete with this extraordinary colour-giving root, but we intend pursuing our researches in the hope of employing it as a substitute for safflower or cochineal, two colouring matters, the price of which is sufficiently high to induce us to continue our investigations. We may add, that our imitation of safflower colour stands soap and light, whilst safflower colours do not.

I shall now draw the attention of the meeting to the preparation, dyeing, and printing of a magnificent crimson colour, called murexide, obtained from guano, a substance which, until lately, has been entirely imported for agricultural purposes. The interesting application of this colour to calico-printing has been, like many valuable chemical discoveries, progressive, and has only been brought to successful commercial application by successive discoveries, made by various persons.

Prout was the first chemist to remark that if the fœces of serpents were heated with nitric acid, and a little ammonia added, a beautiful purple colour was produced. He named it purpurate of ammonia. This substance, when dry, has the appearance of a dark-red powder, soluble in water, to which it communicates a magnificent red colour. This solution not only gives a precipitate with metallic salts, but when evaporated yields beautiful crystals, having the iridescent appearance of the wings of cantharides.

This discovery has also been useful to medical men, by enabling them to distinguish the uric acid calculi.

Messrs. Liebig and Wöhler had also investigated the subject, and succeeded in obtaining from the uric acid contained in the fœces of serpents this substance, which they called murexide, and a new class of organic substances, the knowledge of which has much facilitated the application of murexide to dyeing and printing. Mr. Saac was the first to apply the products of uric acid to the dyeing of fabrics; his process consisted in dipping woollen fabrics, prepared with a salt of tin, into a weak solution of alloxan, a product discovered by Liebig and Wöhler, in heating urea with nitric acid. The fabric so prepared was dried, and when submitted to heat a fine crimson was generated, the intensity of which was increased by the fumes of ammonia. But owing to the

difficulty of obtaining a colour of uniform shade, Mr. Saac's process required improvements, and these have been effected by Mr. Schlumberger.

The process followed by Messrs. Saac and Schlumberger, could not be applied to silk or cotton fabrics. The method of dyeing silk with murexide was discovered by M. de Pouilly, who adopted the following processes, viz., dipping the silk in a concentrated solution of bichloride of mercury mixed with murexide, squeezing the silk well and hanging it in the air, when a magnificent crimson insoluble compound is fixed on the silk. This effect is produced from the fact that when solutions of bichloride of mercury and murexide are mixed together, an insoluble compound is only formed after the lapse of an hour or two.

The process for dyeing cotton is due to Messrs. Lauth and Schlumberger, and consists in producing on cotton a purpurate of lead by mordanting with nitrate of lead, passing into an alkali, and then dyeing in a solution of murexide; in order to give full brilliancy to the colour, it is lastly passed through a weak solution of bichloride of mercury. This process was further improved by Messrs. Dolfus, Meig and Co., in France, and Mr. Lightfoot, in Lancashire, by printing murexide with an excess of nitrate of lead, and subjecting the cloth so printed to the action of ammoniacal fumes, or passing it through a solution of caustic soda mixed with sal ammoniac. In order to render this substance more generally useful, it remained to find a method for obtaining fast colours with it on mixed fabrics, such as mousseline de laine, and this has also been effected by Mr. Schlumberger. The cloth is first prepared by uniting binoxide of tin with the wool. This object is attained by using a salt known to calico printers as pink salt, the double chloride of ammonium and tin, and then printing on the prepared fabric the following mixture:—

1 part of murexide.
6 parts of nitrate of lead.
2 parts of nitrate of soda.

The pieces are then allowed to age for two or three days, when, to fix the purpurate of lead on the cotton, and the purpurate of ammonia on the wool, it is necessary to pass the cloth into a bath of bichloride of mercury, composed as follows:—

Water	100 gallons
Bichloride of Mercury	6 pounds.
Acetate of Soda	12 pounds.
Acetic Acid	2 quarts.

Until recently, all the green colours produced on fabrics were the results of blue and yellow mixed together; but of late public attention has been drawn to a green matter discovered by the Chinese, and fixed by them on cotton. It has been ascertained that they prepare it, by a long and tedious process, from two plants called Pa-bi-lo-za (*Rhamnus chlorophorus*) and Hom-bi-lo-za (*Rhamnus utilis*), and sell it in small square cakes, under the name of Luh-kaou or Luh-chao. The first commercial importation of this colour, new to us, is quite recent, as the first public sale of it in England took place a week ago, at the quarterly indigo sales, under the name of China green indigo. No sooner had a foreign green substance been brought to our notice, than in Europe we had succeeded in obtaining also a green dyeing substance from the plants which surround us, and Mr. Schlumberger has been fortunate enough to fix on woollen fabrics the green chlorophylle, or colouring matter of leaves and grass. This discovery will, in time, prove of great service to dyers and calico printers. Mr. Schlumberger's process consists in boiling 60 lbs. of grass with 25 gallons of water. This operation is repeated, and the grass then treated with 25 gallons of soda lye, with addition of 2 to 4 lbs. of Mercer's dung substitute (phosphate of soda and lime). Boil half an-hour, and then add excess of hydrochloric acid; a green precipitate falls, which is separated by filtration. The precipitate is dissolved in very dilute soda lye, adding a little of the substitute, and the silk or wool to be dyed is dipped in until the desired shade is obtained. Stannate of Soda is the only mordant which gives any beneficial results.

M. Pelouze has rendered lately a great service to Turkey red dyers by enabling them to use any oil, instead of only Gallipoli oil, and this of special quality. M. Pelouze has discovered that the difference there was betwixt a Gallipoli oil, which could be employed with advantage to produce a Turkey red on cotton, and one which could not, was, that the first contained a large proportion of free fatty acids, whilst the latter was nearly neutral. This led Mr. Pelouze first to prepare, artificially, oils of good quality for Turkey red by mixing oleic acid with neutral oils; and, secondly, to the interesting scientific observation that oils were susceptible of undergoing a spontaneous fermentation as well as saccharine juices, or other organic fluids. Thus, immediately the neutral fatty matters in the cells of fruits or roots are brought in contact with the ferment which all vegetable substances contain, by breaking the cells in which the fatty matters are deposited, the oil enters into fermentation, and the fatty acids are liberated from the glycerine with which they had been combined. This discovery gives us an insight into the acidity of some oils and the rancidness of others.

Patent Gum.

One of my late assistants, Mr. Edward Hunt, has just patented a discovery of much value to several trades, and especially to calico printers, who employ large quantities of various preparations of farina, sago, wheat, starch and flour, as a substitute for gum arabic, to thicken the mordants and steam colours. We shall better appreciate the value of the discovery made by Mr. Hunt, when we reflect that hundreds of tons of the above preparations are employed annually, and that most of the substances used are articles of food, for by this discovery a great saving in quantity is effected, two pounds of Mr. Hunt's gum thickening as well as three pounds of ordinary calcined farina. This new gum presents also the three following advantages, viz., being nearly white, perfectly soluble in cold water, and this solution not being acid. The patent gum is manufactured by adding to one ton of dry farina 60 gallons of buttermilk, and calcining the whole in the ordinary way. Strange to say, the action of the lactic acid on the caseine and albumen of the buttermilk, is such as to render them, as well as the farina, soluble in water.

Sulphurous Acid.

The application of this acid to manufactures has been much impeded by the difficulty which the preparation of its solution presents on a large scale; for the production of sulphurous acid, as given in books, is always dangerous, especially when its solution has to be prepared in large quantities. This difficulty I have overcome by a process which I here give to the public, and which enables me to prepare thousands of gallons per day of a saturated solution. The process consists in burning sulphur in a small furnace, and conducting the acid gas through earthenware tubes, surrounded with water so as to cool them. It is then made to ascend through a wooden column, 40 feet high and about 4 feet wide, filled with pumice stone which has been previously washed with muriatic acid and then with water. Whilst the acid ascends through the porous pumice stone, it meets a certain and known quantity of water descending, which dissolves the acid; by opening, more or less, a valve at the top of the column, a more or less rapid current is established. With a little care, a saturated solution runs out constantly from the bottom of the column into a confined reservoir, in which it is stored for use until required.

Refining of Sugar.

I was led to apply the above process, from a wish to use sulphurous acid in sugar-refining, convinced that it would be far superior to the sulphite of lime (which

was so strongly recommended, a few years ago, by MM. Dumas and Melsens), because that by its volatility it would not remain in the syrups or molasses, and give them, as the sulphite does, a disagreeable taste, in consequence of the lime of the sulphite remaining in the syrup as acetate and lactate. These anticipations were not only realised, but I also found that sulphurous acid possesses two advantages for the sugar-refiner. 1st. That it stops the fermentation of his hot liquors as they come out of the char-filters; and 2ndly, when properly applied, it tends to prevent the re-colouration of the liquors during their concentration in the vacuum pan. In practice, I found that very successful results were obtained by adding two gallons of a saturated solution of sulphurous acid to every 100 gallons of decolourised liquor, as it left the char-filter, and was collected in tanks, until pumped up or run into the vacuum pan.

A M. Basset called the attention of the French Academy to a process which, he states, offers decided advantages. It consists in adding a solution of soap to that of molasses or sugar in the blowing-up pans. The following chemical action ensues. The fatty acids of the soap unite with the lime, which always exists in those impure sugar solutions even when lime has not been added by the refiner; and stearate of lime, as it falls, carries with it some of the colouring matters, thus facilitating the decolouration by the char. The alkali of the soap remains united with the acids which were previously combined with the lime.

Diseased Beers.

Several brewers of late have suffered by their beer becoming rapidly sour after it was barrelled, owing to an acetic fermentation succeeding an alcoholic one. I was consulted as to the best means of preventing this acid fermentation, and the process recommended by me is very simple and practical. It consists in the employment of sulphurous acid in solution or as a gas. But I found that mere sulphurization of the casks did not suffice. To ensure perfect success, it is necessary to soak well the fermenting vats and barrels, and also to thoroughly wash the coolers with a solution of sulphurous acid, in fact, all the various vessels used in a brewery should be treated by this antiseptic before satisfactory results are obtained.

On the Puddling of Iron.

Great numbers of patents have been taken out to effect improvements in puddling, either by modifying the form of the furnace, or by employing various chemical mixtures, and several of these investigations have led to the discovery of the manufacture of puddled steel by Captain Uchatius, Mr. R. Mushet, and Mr. E. Riepe. Whilst reading the interesting paper of Mr. W. Clay, which he communicated to this Society on the 15th of January, it occurred to me that some improvements could be effected in Mr. Riepe's process, as well as in some of the others, if attention was drawn to some results published by Mr. R. Johnson and myself on the chemical changes which pig iron undergoes during its conversion into wrought iron, for it will be observed in looking over the following table (which contains a *resumé* of our results) that it is unnecessary to add various mixtures to melted pig iron during its conversion into wrought iron to stop its complete conversion, and to produce puddled steel. If mixtures of various kinds of iron have been employed, or chemical mixtures added, it is because no one had undertaken the long and tedious analysis of the various chemical changes which pig iron undergoes during its melting, boiling, and granulation in the puddling furnace. To have an insight into the phenomena, we took samples from the melted mass contained in the furnace at every well-characterised stage of the operations, and these are the results of our investigations.

No. of Sample.	Time when taken.	Stage of the Operation.	Appearance of the Sample.	Carbon.	Silicium.
Pig-iron used	12.0		Grey No. 3, cold blast Staffordshire	2·275	2·720
1...............	12.40	Just after melting	White and brittle, like refined metal.........	2·726	0·915
2...............	1.0	Perfectly fluid	Same as last.....................................	2·905	0·197
3...............	1.5	Just on the boil	Black mass, composed of very small brittle granules.....................................	2·444	0·194
4...............	1.20	Full boil.........................	Black swollen mass, composed of very small brittle granules	2·305	0·182
5...............	1.35	Just after boil	Black mass, composed of rather larger granules, which are slightly malleable...	1·647	0·183
6...............	1.40	After the boil	Black mass, composed of much larger malleable granules.....................................	1·206	0·163
7...............	1.45	Globules welding together	Black mass, large malleable globules.........	0·963	0·163
8...............	1.50	Part of ball	Same as above, but the mass more compact..	0·772	0·168
9...............		Puddled bar	Good quality.....................................	0·300	0·120
10...............		Wire	Good quality.....................................	0·111	0·088

Composition of the Iron used.

Carbon	2·275
Silicium	2·720
Phosphorus	0·645
Sulphur	0·301
Manganese and aluminium	traces
Iron	94·059
	100·000

Composition of the Scoria or Slag.

Silica	16·53
Protoxide of iron	66·23
Sulphuret of iron	6·80
Phosphoric acid..	3·80
Protoxide of manganese	4·90
Alumina......................................	1·04
Lime	0·70
	100·00

Without entering here into the chemical details of analysis, &c., I think it my duty to draw attention to several facts which the above results illustrate, viz., that the silicium in the cast-iron is oxidized during the softening and smelting of the pig iron, whilst the carbon remains stationary, or even increases, and that it is only after the boil that this substance is really removed from the iron. It is curious to observe that the cast-iron should remain in the furnace one hour, and in a fluid state for above 20 minutes, without losing more than a trace of carbon, whilst in the 20 minutes which follow (from 1.20 to 1.40), the cast-iron loses 50 per cent. of the carbon it contains, and if the partially melted mass now in the furnace were taken out, squeezed and rolled out, I have little doubt that it would be found to be puddled steel, for it would contain about the right proportion of carbon, viz., one per cent. Lastly, I would remark that the purpose of the early formation of the scoria, or slag,

is to preserve the iron from a too rapid oxidation, and give time to the carbon to separate from the iron during the phenomenon of the boil, when ultimately it is consumed, as seen in the above table. The scoria or slag contains nearly the whole of the silicium, sulphur, and phosphorus existing in the pig iron.

I believe it will be useful to some members of this Society to be made acquainted with the composition of a mixture for welding iron and steel together, published by Mr. Rush. It is well known that the welding of these substances is not only difficult, but requires much skill from the workman who performs it. The process now followed consists in heating to a proper temperature the pieces of iron or steel to be welded, and then adding sand or a little borax on the surfaces, which, by dissolving the oxides of iron, renders the metallic surfaces clean and susceptible of welding. A Swiss workman some time ago found out, and used, with great advantage, a mixture for the above purposes, at the steel works of Durkheim, and Mr. Rust found this mixture to be composed of—

Borax	61·00
Sal ammoniac	17·25
Ferrocyanide of potassium	16·75
Rosin	5·00
	100·00

This composition being rather expensive, Mr. Rust was induced to make a series of experiments on this subject, and he succeeded in finding a cheaper and more effective mixture, which is composed of

Boracic acid	35·6
Common salt	30·1
Ferrocyanide of potassium	26·7
Rosin	7·6
	100·0

To weld steel with steel, he recommends the following proportions:—

Boracic acid	41·5
Calcined common salt	35·0
Ferrocyanide of pottassium	15·5
Anhydrous carbonate of soda	6·0
	100·0

Mr. Charles Lowe and myself, have lately found out a new method of stiffening fustian and other goods, which presents the following advantages over the old process, viz., that whilst it satisfies all commercial requirements, it is free from that noxious and offensive smell so well-known to all who have had to deal with fustians and other goods stiffened with putrid bone size. It consists in the employment of a mixture of vegetable substances. It is little liable to mildew. This process is now being extensively carried on by Messrs. Joshua Scholfield and Sons, of Manchester.

I cannot refrain from mentioning some valuable results, published by Professor William Thompson, of Glasgow, on the relative conducting power of various samples of copper wire from different manufacturers, and it will be seen by the following table that wires of the same diameter varied as much as 50 per cent. according to the quality of the metal of which they had been made. Professor Thompson, knowing how important it would be to Electric Telegraph Companies to ascertain the cause of this variation in conducting power, made a series of experiments by which he found that fractional quantities of various metals, added to copper, modified in a remarkable manner its conducting power, as shown in this table.

Conductibility of Copper Wire.

Test sample	100·
Later samples (A) single wire	51·5
,, ,, (A) strand	47·5
Last samples (A) single wire	42·
,, ,, (B) single wire	52·
,, ,, (B) strand	58·7
,, ,, (C) single wire	86·8
Two other manufactories:—	
(E)	85·
(E)	71·3
(F)	87·
(F)	85·
Common copper wires (purchased in Glasgow)	48·9
	45·2
	89·2
Silk covered wire (from Manchester)	53·
	88·8

Specimens prepared by Messrs. Matthey and Johnson.

Pure copper			100·
Alloy of ditto, with	0·25 per cent.	silver	105·5
,, ,,	0·13 ,,	,,	106·
,, ,,	0·25 ,,	lead	109·9
,, ,,	0·13 ,,	,,	111·2
,, ,,	0·25 ,,	tin	99·8
,, ,,	0·13 ,,	,,	101·4
,, ,,	0·80 ,,	zinc	95·
,, ,,	0·40 ,,	,,	91·7
,, ,,	1·40 ,,	,,	78·5

In conclusion, allow me to draw your attention to the importance of establishing, in this country, a school or college for teaching chemistry as applied to the Arts and Manufactures. Nothing would tend more powerfully to benefit the commercial and manufacturing interests of the country than such an establishment, and I cannot but feel that there is no body of men in England so able effectively to promote this object, and to devise the best means of carrying it out, as this most useful and valuable Society.

DISCUSSION.

Mr. G. F. Wilson, F.R.S., hoped he might be allowed to correct a slight error made, he had no doubt, inadvertently by Mr. Crace Calvert, in one part of his subject. He had stated that the oleic acid, manufactured by Price and Co., at Vauxhall, was now made applicable for Turkey red dyeing, through the discovery of Pelouze. The use of oil in Turkey red dyeing, was too important a one to have been overlooked by Price's Patent Candle Company. After seeing the various results obtained from different samples of olive oil by the manufacturer's test, they investigated and discovered the cause, and described the use of oleic acid in a specification years before Mr. Pelouze's paper. While making this correction, he begged to say he entirely concurred with Mr. Calvert in his opinion of the value of Pelouze's discovery of the ferment acidification of oils. To all those engaged in experiments on fatty bodies, this discovery gave at once the clue to what had long been a great puzzle.

Mr. Pearsall wished to express the gratification with which he had listened to Mr. Crace Calvert's paper. With reference to the employment of soap in the process of sugar refining, and with regard to the use of sulphurous acid in the same process, he could not but admire the great caution with which Mr. Calvert had spoken of these new discoveries, abstaining from anticipating the results which time and practical experience alone could give. The manner in which views had been advanced upon discoveries not yet quite matured, was, in his opinion, an example worthy of imitation, and those who were merely acquainted with the theories of these new discoveries might derive a useful lesson from the way in which the method of employing sulphurous acid

in the process of brewing had been gradually carried out to a successful issue. Amongst the many points introduced by Mr. Calvert, he thought none was more worthy of attention than the effects produced at different stages in the puddling of iron, as shown in the analyses taken at different times during the process; the results at each stage having been determined with the greatest nicety. One of the most striking facts introduced to their notice, was that with regard to the different conducting powers of copper wires in proportion to the alloys they contained. The results were certainly most extraordinary, and gave evidence of the advantage of complete examination at progressive stages of a process, the influence of very minute quantities of foreign matter being found to be so great.

Dr. PRICE would beg to make a few brief remarks in reference to that portion of Mr. Crace Calvert's interesting paper which related to the puddling of iron. He was induced to do so as he had, a few years since, in conjunction with his friend Mr. Nicholson, made a chemical investigation of the changes which took place during the refinery process. They found that in this operation the silicium was the first element that was oxidised, and that it was, as shown in Mr. Calvert's table, almost totally eliminated before the amount of carbon was materially diminished. The product of the refinery process known as "metal," might, in fact, be regarded as the purest kind of cast iron. Its hardness, however, prevented its being used for foundry purposes. It dissolved wrought iron with facility, and the product was steel. Steel had been made experimentally at Sheffield by this process, and with satisfactory results. With pig iron it mixed perfectly in every proportion, thereby enabling ironfounders to produce a cast iron of any quality. At present this process had not been carried out upon the large scale. The analyses of himself and Mr. Nicholson on the subject had not yet been published, but the facts mentioned had been embodied in patents for cast iron and cast steel, and noticed in some journals.

Mr. HYDE CLARKE expressed a hope that the suggestions thrown out by Mr. Crace Calvert, with regard to the study of applied chemistry, would not be lost sight of by this Society. Anyone who was in the habit of being brought into contact with working men in this country would see the difficulty there was in the way of their acquiring instruction in that branch of knowledge, and in this respect Mr. Calvert had drawn a striking contrast between the condition of the continent and of England. In foreign countries, every encouragement was given for the acquisition of such knowledge, whilst, in England, not only were the opportunities few, but many difficulties were interposed. Although there were good schools of chemistry, yet they were not upon that scale of liberality and practical application which rendered them available for the working man. A case had occurred under his own observation within the last few days in an establishment with which he was connected. A young man, by his talents and assiduity, had raised himself to be a foreman, and he had temporarily suspended his labours and had come from South America to this country, in order to enter upon the study of applied chemistry, with a view to perfect himself in the branch of manufactures in which he was engaged. He (Mr. Clarke) obtained his admission into the School of Mines, and he thought it was a pity that a young man who had displayed such earnest devotion as to travel from the other side of the globe for the acquisition of knowledge requsite for the practice of his art should be obliged to pay any fees at all. The great want of the present day was schools of chemistry, in which the working classes might be instructed in science, which might be applied to the several branches of manufactures in which they were engaged. If the suggestion thrown out by Mr. Calvert were followed up by the action of the Society, some small government grant might be obtained, which could be applied to this object.

The CHAIRMAN remarked that it was said by Sidney Smith, that every individual, however humble, had a perfect right to find fault, but that a man ought to have arrived at very considerable eminence before he should presume to praise. Were he to follow this dictum on the present occasion, it would place him in an awkward position, inasmuch as he was unable to find fault; he must either praise or say nothing at all. There was one point in particular which Mr. Calvert had illustrated in an admirable manner: that was the immense commercial good that arose from abstract studies. There could be no doubt that many of the points put forward that evening had arisen through the abstractedly scientific discoveries made by others. He need hardly allude tc a more marked instance of this than was afforded by the colouring matter called nitroso-phenyline. The discovery of this substance had resulted from the production of dinitro-benzole, dinitrocumole, and other similar compounds, which, at the time they were discovered, appeared useless as regarded their application to the arts and sciences, serving apparently merely to develope general laws, in the investigation of which scientific chemists were more especially interested. But now they found that the prosecution of these researches with a practical end in view, had resulted in the production of these magnificent colours from the oil of coal tar, varied in their hues according to the degree of oxydation or de-oxydation resorted to; but they would never have heard of these valuable productions but for the purely scientific researches of other chemists. This led him to remark upon the beautiful colouring matter produced from coal tar by Müller, called rosolic acid, the discovery of which, by Runge, was suffered to drop for a period of 20 years, having been, during that time, regarded with doubt and suspicion; but the researches of Müller had resulted in the obtaining of this magnificent purple colour by the action of lime on the vapours arising from coal tar. This dye was not at present of general application, but it was likely soon to become so, and he thought there was every probability of this rosolic acid being turned to useful account in manufactures. With reference to the remarks of Mr. Wilson, it was extraordinary how discoveries made many years ago were, after the lapse of time, brought to useful application. The purely scientific discovery of Chevreul, as to fatty matters being composed of fatty acids and glycerine, was almost day by day yielding fresh results, not only in scientific but also in applied chemistry. With reference to the admirable simplification in the production of sulphurous acid, described by Mr. Crace Calvert, it was matter of wonder that this plan had not been long ago adopted. The ordinary process was first to make sulphurous acid, then by a slow and expensive process to convert it into sulphuric acid, and then by another expensive process it was brought back again to the state of sulphurous acid. Why those tedious processes should have been so long employed, he was at a loss to conceive. He thought Mr. Crace Calvert had introduced to their notice the ultimatum of simplicity in the method of manufacturing sulphurous acid. There were many other points worthy of attention, which, however, he would refrain from touching upon, but he was sure they would agree with him, that the Society was deeply indebted to Mr. Calvert for bringing under their notice such a multitude of interesting new facts, each of which was sure to leave a distinct impression. He had great pleasure in proposing a vote of thanks to Mr. Crace Calvert, for his admirable paper.

The vote of thanks having been passed

Mr. CRACE CALVERT said, he felt highly honoured by the way in which his efforts that evening had been received, and he hoped he had been successful in interesting the meeting, and that the desire would be excited for further advance in these matters. Most of the discoveries he had mentioned were recent; where they had proved really successful he had stated it, and where any

doubts existed as to their applicability he had not hesitated to mention them, and in this way he hoped to have the credit of perfect fairness. With regard to the process in the manufacture of iron alluded to by Dr. Price, the sole reason why he had not included it in the category of new discoveries arose simply from an unintentional oversight. He was aware of the improvements so introduced, and subscribed to their great merits and highly practical character. In effecting improvements in the manufacture of iron; they had a difficulty to deal with in the cheapness of the material itself, which rendered it necessary that all improvements made must be very simple and practical. These improvements had to be carried out by a large number of workmen, who were, in many cases, prejudiced, and inclined to opposed the introduction of any new process, which interfered with their preconceived notions, the ultimate benefit to the employer not being considered. He sincerely hoped that the hint he had thrown out as to the necessity which existed for having some proper institution for giving instruction in commercial chemistry in this country might be taken up by this Society. The Exhibition of 1851 showed them too plainly that in productions where art and chemistry came into play, in most cases the continental exhibitors carried off the palm. In fact, many branches of manufacture had been entirely diverted from this country to continental nations. The reason of this was, that the scientific and chemical education of the working classes was cared for in those countries, whilst in England it was totally neglected. In most parts of the continent facilities were provided for instruction in art and the applied sciences; hence their superiority in taste and in the production of that class of manufactures where chemical knowledge was brought to bear. It should be borne in mind that thirty years ago England had everything in her own hands, whilst the continent, being ravaged by war, had neither men, capital, nor the true spirit of commercial enterprise, and yet in thirty years' time foreigners came and carried away some of the medals in those departments in which England was once the mistress. How essential, then, was it to the maintenance of a high commercial position, that we should follow the good example offered to us by the continent, and so educate our rising generation in the application of science to the arts and manufactures, as to enable them to compete with other nations in the various markets of the world.

Mr. Crace Calvert showed numerous specimens, illustrating the various processes described in his paper.

The Secretary announced, that on Wednesday evening next, the 24th inst., a paper by Mr. W. Stones, "On New Zealand and its Resources," would be read.

The following letter has been received since the meeting:—

Sir,—Fully appreciating the importance of Mr. Crace Calvert's remarks "On the Puddling of Iron," I yet think it would be very advantageous to know more details of the experiments on the variation of carbon, &c., at different times and temperatures, as set forth in the table.

I should like, therefore, to inquire, if I may be permitted, through the medium of the *Journal*, whether the results noticed in Mr. Calvert's table are averages of a number of trials; whether the experiments were conducted at one place, with the same quality and (proportionally) amount of fuel and metal; and, lastly, if the temperatures attained were about the same.

I am, &c.,
WENTWORTH SCOTT.

7, Brunswick-terrace, Westbourne-grove,
Feb. 18, 1858.

YORKSHIRE UNION OF MECHANICS' INSTITUTES.

This union of Institutions for the moral and intellectual improvement of the population has now been in existence above twenty years, and during that time it has attained an importance and a magnitude which entitle it to be considered the first in the kingdom. It was established on the 11th December, 1837, at Leeds, and some idea may be formed of its progress from the following statement, showing the number of Institutions at each annual meeting:—

Date.	Place of Meeting.	Number of Institutes in the Union.	Number of Members.
1837	Leeds	13	2,641
1838	Leeds	14	2,418
1839	Leeds	—	—
1840	Leeds	11	1,795
1841	York	10	1,560
1842	Leeds	—	—
1843	Halifax	17	4,175
1844	Wakefield	20	4,581
1845	Bradford	22	4,953
1846	Huddersfield	23	5,594
1847	Sheffield	64	12,000
1848	Ripon	81	14,105
1849	Beverley and Hull	86	15,860
1850	Darlington	109	18,516
1851	Leeds	117	19,293
1852	Skipton	123	19,043
1853	Thirsk	127	18,537
1854	Bradford	128	20,105
1855	York	133	21,000
1856	Middlesborough	130	21,000
1857	Huddersfield	130	21,000

It will be observed by the foregoing statement that, although for the first few years the progress was discouraging, yet after 1842 its value began to be appreciated, and it has since made a steady advance, particularly during the past year, as several Institutions have been added to the union since the last annual meeting, and most of them are in better working order, there being a very favourable increase in the number of pupils of classes.

The principal objects in view in the formation of the Yorkshire Union were the improvement of existing Institutions, and the formation of new ones wherever an eligible opportunity presented itself. The chief means at first adopted were the annual meetings, and the conferences of delegates from Institutes within the Union, whereby there was an interchange of experience and much encouragement given to those who were zealously labouring for the mental improvement of their respective communities. The Union also published an annual report, which, in addition to many statistics, details, &c., of interest to Institutions, contained reports from the associated institutions, so as to bring together the statistics and experience of all.

In the year 1850 the Central Committee took an important step to increase its means of usefulness, and give additional vitality to the operations of the Mechanics' Institutes in Yorkshire by the appointment of a paid lecturer and agent, and the expenses have been met by an appeal to the nobility, gentry, and wealthy manufacturers of the county, many of whom are annual subscribers to the Special Agency Fund.

The affairs of the Union are under the management of a central committee which meets at Leeds, and the principal officers are:—Mr. Edward Baines (President), Mr. Henry Oxley (Treasurer), Mr. James Hole and Mr. James Kilson, junr. (Honorary Secretaries), Mr. Isaiah Dixon (Honorary Secretary of the Village Library), ten

members of committee, of whom six are resident in Leeds and four are representatives of principal Institutes in Yorkshire, and Mr. Barnett Blake (Agent and Lecturer).

The Yorkshire Union comprises all Institutions which include amongst their objects the intellectual advancement of the operative classes, and in which scientific lectures are given. The terms of subscription are:—Institutes having less than 70 members, 5s. per annum; those having between 70 and 150 members, 10s. per annum; and those having 150 members or upwards, 20s. per annum.

An annual meeting of one delegate from each Institute having less than 200 members, and of two delegates from each Institute having 200 or more members, is held usually on the Wednesday in Whitsun-week, at some town in Yorkshire selected by the delegates at the previous meeting. The business transacted is the reading of the report of the committee, the election of officers of the Union for the ensuing year, the choice of the next place of meeting, and the discussion, as far as time will permit, of such subjects as may be of interest or likely to promote the successful working of the Institutes. The delegates afterwards dine together, and in the evening a public meeting is held, at which usually some nobleman of distinction takes the chair.

The report, which is published shortly after the annual meeting, contains the report of the committee and the business transacted at the annual meeting; several extracts from other publications on subjects of interest; a list of lectures by the agent, with terms and periods of visits to the several parts of the country; a list of 104 manuscript lectures which are lent to Institutes on payment of a small fee; a list of names and addresses of gentlemen who will give gratuitous lectures to Institutes in the Union; a list of professional lecturers, with their addresses, terms, &c.; a list of subscriptions to the Union, treasurer's account, &c.; and a copious appendix containing, in alphabetical order, reports from the several Institutes in the Union. It concludes with a carefully prepared tabular view of the Institutes, showing in parallel columns the number of members in each, increase or decrease from the previous year, average of members to population, rates of subscription, annual income, number of books in each library, number added during the year, extent of circulation, periodicals in reading-rooms, distinguishing weekly, monthly, quarterly, and newspapers. Lectures delivered during the year, distinguishing paid and unpaid, also scientific, literary, and musical, and members of pupils in classes, stating the subject taught and the average attendance of each.

The services of the agent are devoted to delivering lectures at such Institutes as may require them, speaking at soirées or public meetings in behalf of Institutes, conferring with Committees of Institutes whenever they may require his advice, visiting places where an opportunity may present itself for the formation of an Institution, and assisting in such formation wherever his services may be required. In cases of lectures or attending soirées, his travelling expenses are paid by the Institute inviting him, but in other services his expenses are paid by the Union.

The Yorkshire Union also possesses a library for circulation in villages and small towns, the object being to provide the means where they do not exist for encouraging a taste for a better class of literature than is usually within the reach of the inhabitants of such localities. It comprises 45 sections, each containing 50 volumes, judiciously assorted, and the terms are a subscription of 1d. a week, or 1s. a quarter; 25 subscribers being entitled to one section, 50 subscribers to two sections, and so on in proportion, 10 per cent. being allowed to the local librarian for his trouble, and the expense of carriage being paid by the Union.

The committee have also recently purchased, at a cost of £50, an apparatus for the exhibition of dissolving views and the oxy-hydrogen microscope, the objects being of an instructive rather than of an amusing character, the chief design being to excite attention to the wonders of nature and art, and to promote a desire for mental improvement in communities which cannot otherwise be successfully appealed to.

Every year a parcel is forwarded to each Institute in the Union containing copies of the report, and such publications, official returns, and other documents as may be sent to the committee for distribution to the several libraries and reading-rooms.

One of the great advantages of the Union is the facility for organisation, and obtaining an expression of public opinion whenever united action may be desirable. It is a centre from which communication may at all times be made with all the Institutions in Yorkshire, and where advice or assistance may be sought in the promotion of any steps for the mental improvement of the operative classes.

The value and importance of the Yorkshire Union have been abundantly proved in the immense increase which has taken place, not only in the number of Mechanics' Institutes in Yorkshire, but in the really practical working of them, as shown in the number of candidates for certificates at the Examinations of the Society of Arts at Huddersfield. The labours of the agent are devoted not only to the delivery of lectures and to taking part in the proceedings of annual soirées, but also to visiting the several localities, and by advice and suggestions founded on long experience, assisting to remove obstacles to success, and pointing out increased means of usefulness. The extent of his labours may be shown by the last report, which states that during the previous year he had delivered 113 lectures, spoken at 31 soirees, and made 86 other visits to Institutes or places where an opening appeared to present itself.

If any further proof were needed of the advantage arising from the promotion of mental cultivation and the spread of intelligence amongst the operative classes, it might be adduced from the experience of the last few months. The recent monetary panic has caused thousands to be thrown out of employment, and yet in no case has it been found necessary to call for additional aid to maintain the public peace. No longer guided by the mere impulse of passion, the operative classes have shown themselves accessible to reason, and amply justified the labours which have been bestowed so prominently by the Yorkshire Union to promote their moral and intellectual prosperity.

The following are the rules of the Yorkshire Union Itinerating Village Library:—

1. That a series of Libraries be formed, to be called "The Itinerating Village Library," for the purpose of lending books to the inhabitants of villages where no Institution or local library exists, or where other circumstances render it desirable.

2. That the subscription requisite to constitute a subscriber to the library be 1d. per week, or 1s. per quarter, paid in advance, and that the number of subscribers requisite to constitute a library station be not less than twenty-five. That, wherever practicable, the sum of £3 be also raised at each station towards the original cost of the books.

3. That the control and management of the Library be intrusted to a Committee, consisting of the Central Committee of the Yorkshire Union, together with one delegate elected by the subscribers at each of the stations, where there are not less than fifty subscribers. That this committee shall meet at least once every three months, three to be a quorum. The committee shall select and purchase books, and solicit donations of money and books for extending the operations of the library. They shall be empowered to engage a general librarian, the local sub-librarians, and such other officers as may be requisite; to fix the period for which each book shall be lent, and the amount of fine for neglecting to return it at the spe-

cified period; and generally to pass such bye-laws as may be requisite for the proper management of the business entrusted to them. The seat of the committee to be in Leeds.

4. At each station where there are fifty subscribers or upwards, the subscribers shall have the right of annually electing one representative to the annual meetings of the Union. The meeting of the subscribers for this purpose to be summoned by the local librarian, one month previous to the annual meeting of the Yorkshire Union of Mechanics' Institutes; and the name of the delegate appointed to be immediately sent to the Secretaries of the Yorkshire Union.

5. That the duties of the general librarian shall be to purchase the books ordered by the Committee; to submit all donations of books to their sanction; to obtain catalogues of books from the various booksellers and publishers; to see that all books issued to the local stations are in proper condition, and stamped with the Union stamp, and generally to watch over the interests and discharge the duties connected with the Library. The remuneration for his services to be determined by the Committee.

6. That the duties of the local librarian shall be to issue books to the subscribers, and receive them back, keeping a record of the same; to receive the subscriptions and hand them over, with a list of the subscribers verified by the auditors, to the cash secretary, every three months; to see that any books lost or damaged by a subscriber are replaced by him; to forward the sections half-yearly to Leeds, or such other place as the Committee may direct; and to canvass for new subscribers in his district. That an acknowledgment be made to the local librarian of one-tenth of the subscriptions received by him, except when otherwise determined by the Committee. The librarian at each station shall be provided with a book for registering the issues of the books under his charge, and another for keeping an account of subscriptions and fines, and that the entries be made, and the accounts kept, and the same presented to the Central Committee; and that as often as the latter shall direct, both, or either, of the books shall be sent for their inspection, and shall at all times be open to the examination of an auditor appointed by the subscribers.

7. That the cash secretary receive and examine the accounts from the local librarians, and pay all monies into the hands of the treasurer of the Yorkshire Union of Mechanics' Institutes, who shall keep a distinct account of the same.

8. That the library be divided into sections, each containing fifty volumes, and that the sections be distributed among the stations in the following proportions:—

Stations containing		Shall be entitled to	
25 or more subscribers	......1 section or	50 vols.	
50 ditto.	......2 ditto.	100 do.	
75 ditto.	......3 ditto.	150 do.	

Or in the above proportion, and so on; every additional twenty-five subscribers being entitled to an additional section of fifty volumes. The section to be changed every six months.

9. Each section of fifty volumes to contain a well-selected variety of books, so as to be (as far as possible) complete in itself. No volumes belonging to one section to be intermingled with those of another section. All volumes issued to the stations to be progressively numbered, and stamped with the words "Y. U. Itinerating Village Library, section A, B, C, D," &c. All additions to the library to be reserved until the number and variety are sufficient for a complete section.

10. That in order to protect the property, the libraries shall be vested in the following seven trustees, elected, in the first instance, by the Central Committee:—W. F. Hook, D.D., Edward Baines, John Hope Shaw, James Kitson, Wm. Crowther, Thos. Dawson, and James Hole. Whenever the number of trustees is reduced to three, the Central Committee and delegates shall elect four additional trustees to supply the vacancies.

All applications for libraries, and all payments on account of the library, or communications in reference to them, to be made to Mr. Isaiah Dixon, Hon. Librarian and Cash Secretary, Mechanics' Institution, Leeds.

*** All books, when exchanged, to be returned to Mr. Duthie, 17, Albion-street, Leeds.

SOUTH KENSINGTON MUSEUM.

During the week ending 13th Feb., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 3,056; on Monday and Tuesday, free evenings, 3,756. On the three Students' days (admission to the public 6d.), 1207; one Students' evening, Wednesday, 349. Total 8,368.

Home Correspondence.

STEAM CULTIVATION.

Sir,—I did not, as reported in the *Society of Arts Journal*, state that I employed my steam machinery upon an average 39 days in the year, but that I had used it 39 days in the two years from January 30, 1856, down to the present time.—I am, &c.,

W. SMITH.

Woolston, Feb. 14, 1858.

Sir,—I much regret the discussion on Mr. Clarke's paper on steam-ploughing was not adjourned, the more so, as, from the interest excited, as shown by the number of agricultural gentlemen present, doubtless, many valuable facts relating to the benefits of deep cultivation would have been brought forward, which would have cheered inventors in their exertions.

Having been engaged for Mr. A. D. Lacy, of Thirsk, for upwards of twelve months, in maturing the details for the patent numbered 2,641, of the year 1855, I will venture to enter my protest, on the part of Mr. Lacy in particular, and of the various patentees in the line of cultivating by steam in general, against Mr. Fowler's insinuation that it is necessary, for the progress of the subject, that the public should render aid, other than patronage when the inventions are perfected. We doubt not, ample tangible remuneration will be the lot of those who succeed, by their inventive faculties, in rendering the slightest assistance to the good cause, even though they are not enabled to secure by patent the particular invention they introduce to the public.

This, I believe, is now the case with Mr. Fowler; as, if I read the drawings on the walls of the Institution aright, he comes now to the application of the capstan for actuating an endless rope. It is true, he has adopted in that design the form with two grooved drums, known by the practical mechanic as having been applied by Messrs. Sharp and Roberts in their pillar cranes.

In the patent numbered 1,989, of the year 1857, it will be found that we claim the application of the capstan, in this and other forms, to the actuating of the necessary ropes or chains used for conveying motion to agricultural implements, but disclaiming it when the rope is endless. I wish to put on record our reason for the disclaimer, this having been simply Lord Willoughby D'Eresby's publication and mode of operations.

Doubtless, Mr. Fowler's plan is an improvement in detail on Lord Willoughby D'Eresby's, as shown in his publication, on account of the increased diameter of drums; but, having studied the question, I may venture an opinion, that Mr. Fowler, even if using the endless rope, will yet come back to the single ungrooved capstan system, properly proportioned, working upon a vertical axis, and having guide discs, &c., as shown in the detailed

drawings of the patent numbered 1,989, of the year 1857, or some other efficient method of fleeting the rope, &c.

The reasons for entertaining this opinion will be evident to the practical mechanic examining the subject, on account of the undue bending and straightening of the rope when the double cylinder capstan is employed.

Doubtless, much money and time have been spent in bringing the application of the rope-traction system to its present state of efficiency; but I yet think that it must be with a rope of considerable length, used as proposed in the first instance, in the respective patents of Messrs. Lacy, of Thirsk, and Smith, of Woolston, and practised by Mr. Fowler in his first endeavours, thus avoiding the shifting of the engine for less than say 10 acres of land ploughed.

When the drum is used, having the rope coiled and uncoiled from on and off it, it becomes difficult to apply the motive-power in a constant form, from the difference in the working diameters of the coil on the barrel; this inconvenience was, doubtless, found very great, but perhaps not more so than that arising from the immense wear and tear caused by the rope coiling on the top of itself, with a tension of, say a ton. Again, this was greatly enhanced by the absence of any apparatus to cause the rope to coil regularly on the drum—at least, this was a defect I noticed in any machinery I have seen at work; but, in mentioning this, I do not consider it an oversight by the constructors, as practical experience in the use of ropes for other purposes, has taught me the great difficulty of getting any such apparatus to act efficiently when a great strain is on the rope.

It is not for me here to refer to the details of patent number 1989, of the year 1857, but, I do hope, sir, if my health be spared, to be able, before this year is out, to lay before your Society the details of the experiments contemplated when the first set of machinery, under that patent, is completed, which, I trust, will be the case in the course of a couple of months.

I fear I may weary you with the length of this communication, or I would make some remarks upon the rotary digging system, but, as it is, I will content myself by assuring you there is at least one inventor not despairing of success or in want of remuneration till his task be completed. I will only remark further, there are reasonable grounds to anticipate that the prognostications of the judges of the Stirlingshire Agricultural Society will be fulfilled. They say in their report on steam-ploughing to that Society:—"In the progress of improvements, it may not be far distant when the engine will be enabled to do its work efficiently, without the necessity of leaving a corner of the field, and thereby obviate the disadvantage of moving over it."—I am, &c.,

WM. COLLETT HOMERSHAM.

1A, Adelphi-terrace, Feb. 15, 1858.

Proceedings of Institutions.

HANLEY (STAFFORDSHIRE).—A conversazione of the members, exclusively, was held in the lecture-hall of the Pottery Mechanics' Institution, on Tuesday, 9th February. The meeting was numerously attended, and the proceedings were diversified by an exhibition of paintings, engravings, and other works of art, articles of vertu, &c. There were two brief addresses, one by Mr. Charles Alfieri, on "Photographic Art," the other on the "Geology of the locality," by Mr. John Scott. Some performances were given by an Amateur Musical Company.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 8th February, 1858.

8. Bill—London Corporation.
Foreign Refugees—Paper.
Bank of England—Copy of Letter.

Delivered on 6th February, 1858.

26. East India (Mutinies)—Copies of Letters.

Delivered on 9th February, 1858.

37. Naval Receipt and Expenditure—Account.
Riots in Belfast—Report of the Commissioners.
Mutinies in India—Letters from the Court of Directors.
Bessarabian Frontier, &c.—Treaty.
Prussia (Marriage of H.R.H. the Princess Royal)—Treaty.
Sardinia (Post-office Arrangements)—Convention.

Delivered on 10th February, 1858.

29. Public Income and Expenditure (Balance Sheet)—Account.
48. Bank of England—Copy of a Letter.
50. East India Company (Receipts and Disbursements)—Estimate.
12. Bill—Lady Havelock and Sir H. M. Havelock's Annuities.
Foreign Refugees—Despatch from Count Walewski's to Count de Persigny.

Delivered on 11th February, 1858.

27. Navy Estimates.
30. Factory Children (York and Lancaster)—Returns.
33. East India (Bishops and Cathedral Establishments, &c.)—Return.
35. East India (Steam-ship *Austria*)—Return.
36. Metropolitan Improvements—Statement of Advances.
38. Lunacy—Account.
39. Post Office Department (Packet Service)—Estimate.
43. Court of Session (Scotland)—Return.
45. Lighthouse at Godrevy—Return.
6. Bills—Heirs (Scotland).
7. ——— Valuation of Lands (Scotland) Act Amendment.
13. ——— Gaols and Houses of Correction.
14. ——— Portumna Bridge (Ireland).
Certified Industrial and Ragged Schools—Minute of the Lords of the Committee of Privy Council on Education.
East Indies (Mutinies)—Appendix (B) to further Papers (No. 5).

Delivered on 12th February, 1858.

32. East India (Civil Service)—Return.
34. Paper Duties—Returns.
42. Poor Relief (Scotland)—Return.
53. Justices of the Peace (Ireland)—Copy of a Letter.
58. East India (Sepoy at Meerut)—Copy of Papers.
59. East India (Cadetships)—Return.

Delivered on 13th and 15th February, 1858.

55. Savings Banks—Return.
66. Army Estimates.
30 (1). Factory Children (County of York)—Return.
41. Burial Grounds (Metropolis)—Return.
75. East India (Improvements in Administration)—Return.
16. Bills—Ecclesiastical Residences (Ireland).
17. ——— Churches, &c. (Ireland).
18. Church Rates Abolition.
10. Clerks of Petty Sessions (Ireland).

Delivered on 16th February, 1858.

56. East India (Military Force)—Return.
68. Trade and Navigation—Accounts (31st December, 1857).
76. Bank of England—Annual Accounts.
11. Bills—Markets and Fairs (Ireland).
15. ——— Conspiracy to Murder.
Sanitary Condition of the Army—Report of the Commissioners

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
Architects, 8. I. Mr. S. Smirke, "A brief Communication on the subject of Water Supply in Towns." II. Mr. G. R. Burnell, "On the Modern Applications of Hydraulic Limes and other Cementitious Materials to constructive purposes."
Geographical, 8½. I. Mr. Cyril C. Graham, "Explorations in the Desert of the Hauran." II. Mr. Alfred R. Wallace, "Account of the Arru Islands." III. Capt. J. Ballemy, "Extract of the Journal of the schooner *Eliza Scott*."

TUES. Royal Inst., 3. Prof. Huxley, "On Biology."
Civil Engineers, 8. Mr. F. C. Webb, Assoc. Inst. C.E., "On the Practical Operations connected with the Paying-out and Repairing of Submarine Telegraph Cables."
Med. and Chirurg., 8½.
Zoological, 9.

WED. Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. W. Stones, "On New Zealand and its Resources."
Geological, 8. I. Signor G. G. Gemmellaro, "On the Gradual Elevation of a part of the Coast of Sicily." II. Mr. K. Macnab, "On the occurrence of Sea-shells in a Peat-moss at Abernethy." III. Mr. T. F. Jamieson, "On some striated Stones and Sea-shells at high levels in Scotland." IV. Mr. R. Mason, "On Changes of Level in the country near Tenby."
Archæological Asso., 8½.

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.

FRI. Royal Inst., 8½. Prof. Baden Powell, "On Rotatory Stability, and its Applications," illustrated by the apparatus of Prof. C. Piazzi Smyth.

SAT. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Feb.* 12, 1858.]

Dated 23rd December, 1857.

3148. William Nunn, Hackney, Middlesex—Improvements in stereoscopic apparatus.

Dated 7th January, 1858.

26. François Philippe Cappon, Marans, France—Self-acting pads for doors, shutters, windows, or other similar shuttings.

Dated 18th January, 1858.

80. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for the manufacture of pipes and tubes. (A communication.)

Dated 23rd January, 1858.

125. Charles Fréderic Vasserot, 45, Essex-street, Strand—A single and double acting machine with electro-magnetic motive power. (A communication.)

Dated 26th January, 1858.

137. Pearson Hill, Hampstead, Middlesex—Improvements in machinery for making cams and for cutting and shaping metals and other materials.
139. George Price Simcox, Hendham Vale Works, Harpurhey, near Manchester—The application of certain materials in the manufacture of carpets.
141. William Edward Newton, 66, Chancery-lane—Improved machinery for mining coal and other mineral substances. (A communication.)
143. William Davis Hirst, Mount-street, Grosvenor-square—A stand for soda-water bottles and other bottles of a similar form.
144. John Harthan and Ezra Harthan, Timbersbrook, near Congleton—An improved engine for obtaining motive power.
145. Ralph Heaton, jun., and George Heaton, Birmingham—An improvement or improvements in annealing metals.

Dated 27th January, 1858.

147. Arthur Bird, Birmingham—A new or improved spring platform or mattress for bedsteads and other articles used for sitting, lying, or reclining upon.
George James Wainwright, Dukinfield—Improvements in drawing fibrous materials.
149. John Wignall Midgley, Keighley, Yorkshire—An improved construction of covered roller to be used in preparing and spinning machinery.

Dated 28th January, 1858.

150. James Murdoch Napier, Vine-street, York-road, and William Thorburn, 19, Sussex-place, Vine-street, York-road—Improvements in machinery for planing, shaping, and slotting.
151. Constantine Nicolaus Kottula, Liverpool—Improvements in the manufacture of neutral soap.
153. Louis Caemmerer, Ghent, Belgium—Improvements in the apparatus for cleaning the top rollers and fluted rollers of the different spinning machines.
154. William Spence, 50, Chancery-lane—An improved pot for chimneys and ventilation. (A communication.)
155. Edmond Liouvil, Paris—Improvements in apparatus for aerated liquids.
156. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in the manufacture of metal pipes, and in the apparatus employed therein. (A communication.)
157. Thomas Armitage, Hood-street, Coventry—Improvements in elastic fabrics.

Dated 29th January, 1858.

158. William Treleaven Fox, Birkenhead—Improvements in the bending and reefing of ships' and other vessels' sails, together with a new application for the leeches and foot.
159. John Bethell, 8, Parliament-street, Westminster—Improvements in the manufacture of coke and fuel.
160. William Henry Tooth, 9, Summer-street, Southwark—Improvements in polishing plate glass, sheet glass, and other substances.
162. John Elder, Glasgow—Improvements in the arrangement or construction of steam engines and boilers.
163. George Chapman, Leicester—An improvement in socks, drawers, and other garments made of knitted fabrics.
164. Richard Archibald Brooman, 166, Fleet-street—Improvements in apparatus for measuring water, gas, and other fluids. (A communication.)
165. Robert Ware, Plumstead, Kent—Improvements in galvanic batteries.
166. James Wotherspoon, Glengarnock Iron Works, Ayr, N.B.—Improvements in railway brakes.
167. James Goodwin, Milton, N.B.—Improvements in the treatment, preparation, and cleansing of textile fabrics and materials.
168. Herbert William Hart, Birmingham—Improvements in regulating the pressure of gas.

Dated 30th January, 1858.

169. William Kaye and Charles Kaye, Lockwood, near Huddersfield—Improvements in mattocks, picks, hoes, hammers, and similar implements and tools.
170. George Garden Nicol, 37, New Broad-street—Improvements in balls or projectiles. (A communication.)
171. Charles Niellon, 50, Lime-street—Improvements in the manufacture of manure from sewage waters.
172. John Newling, Park-street, Grosvenor-square—An improved truss for hernia.
173. Richard Coleman, Chelmsford—Improvements in agricultural implements.
174. John Augustus Bouck, Manchester—Improvements in the manufacture of sulphate of copper, and in obtaining certain useful products from such manufacture.
175. Thomas Taylor, senr., Thomas Taylor, junr., and Henry Nelson, Manchester, and Henry Spencer, Rochdale—Improvements in steam engines, and apparatus connected therewith.
176. Peter Ashcroft, Engineer to the South Eastern Railway—An improved mode of supporting the rails of railways in their chairs.

Dated 1st February, 1858.

178. William Kemble Hall, 36, Cannon-street—Improvements in the manufacture of artificial leather.
180. George Bartholomew, Linlithgow, N.B.—Improvements in horse shoes, and in attaching the same to the horses' feet.
182. William Edward Newton, 66, Chancery-lane—An improved clasp or fastening for joining the ends of belts or bands. (A communication.)
184. Richard Archibald Brooman, 166, Fleet-street—Improvements in burners for generating and burning gas from hydro-carbon fluids. (A communication.)
186. William John Hay, Southsea—An improved composition suitable for covering the caulking of ships and other like purposes, for uniting wood and other substances, for filling up seams, and for use as a waterproof composition generally.

Dated 2nd February, 1858.

188. William Edward Newton, 66, Chancery-lane—Improvements in obtaining certain compounds of nitrogen to be applied in the composition of artificial manures, and for other useful purposes. (A communication.)
190. James Sholl, Victoria-grove West, Stoke Newington—Improvements in the manufacture or preparation of paper for writing and copying purposes.

WEEKLY LIST OF PATENTS SEALED.

February 12th.

2158. William Smith Wheatcroft and James Newton Smith.
2159. John Alleyne Bosworth.
2167. Charles Gumm.
2169. Samuel Draper.
2190. William Heny Miller and Henry Edward Skinner.
2194. Thomas Keddy.
2214. Amos Pierce Chamberlain.
2272. François Xavier Gentil, senr., and Eugène Gentil, junr.
2284. William Clark.
3044. Samuel Clarke.
3080. Edwin Turner and John Charles Pearce.

February 16th.

2179. Archibald Smith.
2191. Charles Nightingale.
2196. Samuel Bottomley, James Bottomley, and Thomas Bottomley.
2200. Pier Alberto Balestrini.
2204. Ferdinand Potts.
2208. James Murdoch Napier.
2212. Rd. Archibald Brooman.
2217. Thomas Ingram.
2219. Joseph Glover and J. Bold
2221. Victor Hippolyte Laurent.
2222. Peter Ashcroft.
2223. Henry Cartwright.
2225. Jules Dufau.
2233. Ludvig Levison.
2239. Alfred Hamilton.
2241. Thomas Macauley.
2267. William Harling, John Matthew Todd, and Thomas Harling.
2286. George Hallen Cottam and Henry Richard Cottam.
2295. Robinson Elliott.
2308. Perry G. Gardiner.
2310. John Yuil Borland.
2332. William Lewis and William Henry Lewis.
2371. Charles Lungley.
2687. John B. Slawson.
2777. George Hallen Cottam and Henry Richard Cottam.
2238. George Lowry.
2995. Joseph Francis and Charles Manby.
3054. John Chadwick and Arthur Elliott.
3111. Samuel Darling.
3112. Charles Winslow.

Patents on which the Stamp Duty of £50 has been Paid.

February 8th.

308. William Beckett Johnson.
322. John Ramsbottom.
335. John Henry Johnson.
346. Christophe François Delabarre.

February 9th.

313. Edward Sparkhall.
321. George Rennie.
327. Richard Shirley Harris.

February 11th.

328. John Foster.
431. Alex. Theophilus Blakely.

February 12th.

355. Samuel Barlow Wright and Henry Thomas Green.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4056	Feb. 12.	The Hand Seed Planting Machine	Joseph Hoare	Old Fishbourne, Rosham, Sussex.
4057	,, 13.	The Improved Sheep Shears	Robert Sorby and Sons	Sheffield.
4058	,, 16.	Life Preserver	James Armstrong	Irthington, Cumberland.
4059	,, 17.	Spring Hat Suspender	James Chesterman	Sheffield.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 26, 1858.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of *recent* Inventions.

Persons intending to contribute to the Exhibition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.
2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

No charge whatever is made for space, and the Exhibition is free.

ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relative to this subject, has been prepared at the request of the Committee, by D. Roberton Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, Auditor	10	10
Harry Chester, Vice-Pres.	10	10
Henry Cole, C.B., Vice-Pres.	1	0
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

EXAMINATIONS.

On Thursday evening, the 18th inst., a meeting was held at the Burnley Mechanics' Institution, Sir J. Kaye Shuttleworth, Bart., in the chair, at which Sir Thomas Phillips attended as a deputation, at the request of the Council of the Society of Arts, and explained the Society's system of Examinations for 1858. The Committee of the East Lancashire Union of Mechanics' Institutions will form the Local Board of Examiners for that district.

A public meeting was held at Crosby-hall, Bishopsgate-street, by permission of the Evening Classes Committee, on Friday evening, February 19th, J. J. Mechi, Esq., in the chair.

The following gentlemen, at the request of the Council, attended as a deputation:—C. Wentworth Dilke, (Chairman of the Council), Harry Chester and J. Griffith Frith (Members of the Council), with P. Le Neve Foster (Secretary), and Charles Critchett (Assistant Secretary).

The Society's scheme of Examinations for the present year was explained, and the following resolution was carried unanimously:—

Resolved,—That this meeting believes that the system of Examinations of members of Literary and Mechanics' Institutions, as carried out by the Society of Arts, is calculated greatly to promote the cause of popular education; and having been informed of the intentions of the Council with reference to the Examination for the present year, strongly urges upon the Committees and Members of Institutions in London, to co-operate with the Council of the Society in carrying out their scheme.

A vote of thanks was then passed to the chairman, and the meeting separated.

The Committee of the Devonport Mechanics' Institute met on Monday, the 22nd inst., when Mr. Henry Cole, C.B., and Dr. Lyon Playfair, C.B., attended as a deputation, at the request of the Council, to explain the Society's system of Examinations. The Committee unanimously agreed to make the necessary arrangements for the formation of a Local Board of Examiners for the counties of Devon and Cornwall.

TWELFTH ORDINARY MEETING.

Wednesday, Feb. 24, 1858.

The Twelfth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 24th inst., George Moffatt, Esq., M.P., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Clark, George T. | Grove, W. R., Q.C., F.R.S.

The following Institution has been taken into Union since the last announcement:—

456. Londonderry, Young Men's Literary Association.

The Paper read was:—

NEW ZEALAND AND ITS RESOURCES.

By William Stones.

Legendary and Traditionary History.

The early native history, as may be imagined, is entirely traditionary, the art of writing having been unknown to the New Zealanders until introduced by Europeans.

The legend of the origin of the North Island is as follows:—

Maui with his wife were in a canoe fishing, and the line, on one occasion, being pulled in with difficulty, he found that the hook had attached itself to a huge and wonderful fish; and when he had succeeded in drawing it up to the surface, he leaped from his canoe on to the newly-caught monster, exclaiming to his wife, "Whenua," (land)—thus was the North Island fished up from the ocean.

As may be supposed, cross-examination fails to elicit satisfactory answers to the questions:—Where did the tree grow out of which Maui's canoe was made, before the land was formed? Where did he get his fishing line? How had he previously subsisted? The replies being, "Don't know."

Nevertheless, the North Island has no other name than Te ika a Maui—the fish of Maui.

The Middle Island, from the circumstance of the Jade being found there, of which the choice native war weapon used by the chiefs is made, is called Te Wahi Pounamu—the place of the Pounamu.

The sea is called Te Moana, in which word we may detect an attempt to depict the sound of its well-known hollow moan, as it rolls up on to their extensive sandy beaches. The sun is supposed to go down behind the sea, and run through a hole back again at night, returning through the air during the day.

The New Zealanders deny that their forefathers were cannibals, and assert that it is only within the last few generations that the fierce spirit of war has seized them; and cannibalism arose partly from their being occasionally driven to extremities by hunger, and partly from the idea that by feeding upon the killed enemy, the eater would become possessed of the personal strength and bravery of the deceased; and revenge, payment, compensation, "utu," as it was termed, being the absorbing principle of honour, it came to pass that the friend or child of a person slain in fight would cherish the feeling for many years, until some favourable opportunity occurred, when he could avenge his friend or father's death.

One chief, in speaking of a certain district, told the writer that he knew it well. "There," said he, "we had a fight, and I ate such a chief's eyes."

"What quarrel had you with that individual, or with his tribe?"

"None, personally, but he had killed my father when I was a child."

The natives also state that the islands were once more populous than at the present time, and refer to the numerous deserted pahs, or native forts, in support of the statement, but I doubt whether New Zealand was ever much more populous than it was thirty years ago; since that time, for reasons which will be hereafter assigned, the native population has decreased. The number is variously estimated, being a mere conjecture, no attempt at a census, that I am aware of, having been made.

I should myself estimate the native population at from 80,000 to 100,000 souls.

When visited by Cook, the islands were entirely destitute of animals, except a dog and a rat; these probably being the descendants of some which absconded from the earlier ships; the people, therefore, have had no inducement to wander in search of sustenance by hunting, but have always resided in villages, building small huts of rushes, and cultivating kumeras (sweet potatoes), and, when the soil became exhausted, moving to another part of the same valley, allowing the previously cultivated portion to lie in fallow for several years. Each tribe would also plant small quantities of these vegetables, &c., in convenient little nooks near the sea-beach, or by the river side, so that in the proper fishing season the trouble of carriage might be saved.

The tribes consist of a somewhat indefinite mixture of chiefs, free men, and slaves, the last of whom were made

to do the greater portion of the labour, and in battles were placed in front, the chiefs fearing they might otherwise run away, or probably avenge upon their own chiefs some pent-up grievance or offence.

The land, for the most part, is held by a kind of corporate tenure, and when sold, the veriest slave receives some share of the price, if only a piece of tobacco.

I am not aware of a single inch of ground having been discovered which was not the recognised property of an individual or of some tribe in common.

Early Relations with Europeans.

The Dutch navigator, Tasman, appears to have been the first who discovered these Islands, and the names, "New Zealand" and "Cape Maria Van Diemen," are evidences of his visit; but, beyond these mere names, few particulars are on record; nor was he aware that the land he discovered was part of an island belonging to a group.

To Captain Cook belongs the honour of definitely fixing the extent of these islands, and becoming acquainted with the inhabitants and productions; his visits are recollected with gratitude by all, and it is extremely pleasing to hear them talk of Peni Kuki (Capt. Cook), who came in the thing their fathers imagined at first was a huge bird flying on the sea—the sails being mistaken for its suitably vast wings.

To Cook they attribute the introduction of pigs, potatoes, goats, poultry, the cabbage, and the knowledge of the use of iron instruments; and throughout the land his name is mentioned with affectionate remembrance as their greatest benefactor—as one who was ever kind to them, and never took advantage of their ignorance and helplessness against his fire-arms.

I may here remark that the native name for a ship is Kai-puke—" Hill of food;" whether from the large stores they saw on board Cook's vessels, or from the advent of new supplies of food in the shape of pigs, &c., which he left with them, I know not, but it is nevertheless a fact.

Illustrative of the lasting impression which a comparatively trifling circumstance may make at the beginning of the intercourse of civilized with barbarous people, I may remark that Captain Marion, an early French navigator, having had some cause of dissatisfaction with the natives of the harbour wherein his ship was at anchor, took rather severe retribution by destroying several villages on the coast, and killing the inhabitants. He intended to inspire them with a sense of French power, and he succeeded; but, at the same time, he taught hatred, and to this day intense dislike is manifested to the Mareaus or Wiwis, the name given to the French, from their frequent utterance of the words, Oui, oui.

After the settlement of New South Wales was formed, English vessels occasionally called at New Zealand on their way home from that colony, and the account of the massacre of the crew of the *Boyd* gave to Englishmen a horrible notion of the savage character of the natives.

One old Wangaroa chief communicated to the writer his version of the occurrence, and it was thus: "On board the ship were nails, and axes, and iron articles, great prizes to us, and some of our people took them. We now know how wrong you consider it to steal, but we did not understand then; our people saw the iron articles in abundance; they wanted the nails, &c., and took them. The captain purposing (as I now suppose) to intimidate us, seized two of our chiefs and chained them on board. You are now aware that our chiefs are sacred in our eyes, and, as we could not allow them to suffer these indignities, and, moreover, thought the Captain intended to kill them, we resolved to murder the English and release our chiefs,—it was a sad mistake, from kuwaretanga (ignorance) on both sides."

Whaling vessels frequenting the Pacific began to call, in order to obtain water, and such fresh provisions as pigs, potatoes, pumpkins, &c., so desirable and necessary in their long cruises; and the Bay of Islands being a well-sheltered harbour, and easy of access, became the favourite place of resort, until at last two hundred vessels have been known to visit the Bay in one year.

Guns, powder, blankets, clothing of all kinds, and ardent spirits, were thus introduced, and the Bay natives became rich in European goods; unhappily, demoralization resulted from this abundant intercourse with English vessels, and with the good came much evil.

Diseases previously unknown were introduced, and the sad effects of intoxicating habits were too common. Moreover, in a moist climate, it must be apparent that exposure to wet is calculated to induce certain classes of diseases. Before the introduction of European clothes they were accustomed, when wet, to throw off every garment and dry themselves, but since that period, in spite of every warning, the natives, when thoroughly drenched, will stand over the fires in their huts until perfectly dry: hence the frequency of pulmonary complaints amongst them, and, from the causes named, a decrease of population.

Irregular Settlement.

Captains and mates of whalers and trading vessels from New South Wales, who had been to the place for supplies, particularly in seasons of drought in the Australian colony, became enamoured with the wild romantic freedom of the land contrasted with the stringent formal regulations of the convict colony; there was a charm connected with the idea of being regarded as a little king amongst a tribe; there was mildness of climate, surpassing beauty of scenery, and noble rivers sweeping through thickly-timbered forests, interspersed with lovely fern valleys, whose rich soil, unvisited by drought, brought forth abundantly.

Seamen also thought it would be an easy, merry life, to dwell where tobacco and grog were untaxed and enticingly cheap, being easily obtainable in any quantity, by top-sawing if an experienced hand, and bottom-sawing until he had learnt the mystery.

Thus the one class, retiring masters of vessels, opened stores, where the natives obtained whatever European articles they desired, for which they exchanged agricultural produce; and from these storekeepers, shipmasters visiting the Bay procured provisions and other stores of which they might be in need; the other class, the seamen, set up grog shops for the accommodation of Jack ashore, and so Kororareka became a little British town.

Others located themselves near to the native villages, a proceeding always encouraged by the chiefs, because they reasoned that wherever a white man went, thither would follow white men's goods, and to obtain these was their great anxiety. The foreign trade, if I may so term it, they left to the superior arrangements of the Europeans, but every tribe was particularly anxious to secure the near residence of a pakeha, or white man, for the reason stated. Hence they readily parted with plots of land for the white man's house and farm; in the first instance no cause existed to limit his purchases, for there was abundance for all, and, as may be supposed, the payments for land were not large; and what was it worth thirty years ago? Moreover, the settlers who first purchased land in New Zealand had come from the colony of New South Wales or Van Diemen's Land, where the land was then being given away by the Government; consequently their idea of the value of land was not very excessive. The settlers agreed to pay whatever the natives demanded;—it was unoccupied; and just as a Canadian clearing increases the value of the adjacent lands, so the presence of an European increased the value of the property unsold, for he opened a near market for its produce.

Verily, the sweeping accusation as to land-jobbing comes with an ill-grace from Government, who at the very moment when these properties were being bought, were giving away land in other colonies, and who, as I shall subsequently show, have since proposed to assume

the proprietorship of those very unoccupied lands without any payment at all.

As whales were observed to frequent the coasts of New Zealand, the merchants of New South Wales established whaling stations in the neighbourhood of Cook's and Foveaux's Straits, and in those bays to which the whales were noticed to resort. Thus, a large shore population became temporarily located at various points.

That worthy, eccentric clergyman, the Rev. S. Marsden, whose name will pass down the stream of time with the early history of New South Wales, planned a mission to New Zealand, which he personally visited to found, and by degrees the Church Missionary influence became great, and their establishments at Paihia, on the Bay of Islands, and at the Waimate, the latter midway between the Bay and Hokianga, led to the introduction, cultivation, and extensive growth of the vine, water-melons, peaches, apples, and various vegetables; and, by the same means, cattle and horses, goats, sheep, and fowls, ducks and geese, became more generally known to and largely acquired by the natives, and, from the genial character of the climate, thrived amazingly.

A notable character in the early history of New Zealand, the Baron de Thierry, now appears on the stage. He states that he gave a Church of England clergyman a large sum of money, many years ago, to purchase land in New Zealand, and that from this agent he received deeds, setting forth the boundaries of a large district, therein represented to have been sold to the Baron by the natives.

Some years after this purchase, the very idea of which the natives ignore (the only instance of such a denial), the Baron, who had been residing in the Marquesas Islands, of one of which he assumed the title of king, but from disagreement with his subjects, thought it advisable to retire to Sydney, announced his intention of visiting New Zealand, to take possession of his land.

Accompanied by some sixty followers, he sailed from Sydney in a small vessel, and landed on the shores of the Hokianga, of which district he claimed to be the sovereign chief. The long-expected French men-of-war, to support his authority, not making their appearance, and his staff dwindling away as his means became exhausted, Charles, Baron de Thierry in France, King of Nukuhiva, Marquesas, and Sovereign Chief of Hokianga, New Zealand, whose advent had caused much commotion, ceased to—

"Fright the isle from its propriety."

In the year 1839, the New Zealand Company sent out their first ship, the *Tory*, under the direction of Colonel Wakefield, to purchase land, &c. He visited successively Hokianga, where the Company had purchased one or two small properties; Kaipara, where the natives refused to sell any land at all; and then sailed southward, where he effected a large purchase of land on the shores of Cook's Straits, and formed the present settlement of Wellington.

All these various interests (each party being perfectly independent, and owing no allegiance to the others), being thus located in the land, it requires but little consideration to foresee that unpleasant complications would follow. Collisions between native tribes, between natives and Europeans, and amongst Europeans themselves, were already threatening, and would doubtless have soon taken large dimensions, but for the authoritative colonization by the government. I will name but one or two circumstances in proof of the disorganization which existed.

It was a customary matter, and quite expected, that several men of every crew would abscond, leaving the ship so short of hands that the commander could not put to sea when laden. When a ship had taken her cargo on board, the haunts of the runaways being ascertained by native information, two or three captains with their officers would assemble, well armed, and joining their forces and taking the law into their own hands, would, unexpectedly, at night, visit the houses of the sawyers with whom these runaways generally found a hiding place, and threaten that unless the men were delivered up, the house should be broken into (which was sometimes done), and as many of the men as could thus be recovered were brought back to the ship, and as soon as sufficient were obtained to enable the vessel to go to sea with the slightest degree of safety, the commander would get away with all speed.

Frequently, when half-way from the colony of New South Wales, an escaped, starving, convict, would b found in the hold of a vessel, determined at all risks to make his way to that traditional Paradise of the condemned, New Zealand. What was a captain to do? It would only have been troublesome and expensive to have kept these men until they could have been thanklessly delivered to the authorities in England, and to put back would not be profitable, so they were generally made to work during the passage, and part of the time in port; they then disappeared by the aid of the sawyers, some of whom were always ready to lend their friendly assistance for such an escape.

The writer observed one morning a party of forty armed Europeans rowing up the Hokianga, and while wondering as to the object of the expedition, noticed them deliberately break into a timber dock, and steal therefrom timber logs and spars to the value of more than £200, for which atrocity no redress, no investigation by the government, could ever be obtained.

I think we may fairly term this the period of "irregular settlement," when every one did as he liked in his own eyes.

The distribution of letters was on rather an unique principle. The only recognised Postmaster was a merchant at the Bay of Islands, and his was an altogether honorary position. Whenever, on the arrival of a vessel, he found on opening the bag that there were several letters for any district within one or two day's journey, he would enclose them to the principal resident or missionary, who would pay the native bearer, generally with a striped shirt and some tobacco; and the letters being arranged in a row on the mantel-shelf, the addresses would be accessible for the perusal of all chance visitors. Any one happening to call, would say, I am going near to such a person, and will take his letters; thus by slow filtrations did letters and newspapers reach their destination. The writer had one letter delivered to him two years and a week old.

Government Colonization.

To put an end to the anomalous condition of matters we have referred to, the British Government resolved to establish a Crown colony, and to Captain Hobson, who had previously visited New Zealand as commander of one of Her Majesty's ships, was entrusted the delicate mission of treating with the native chiefs for the cession of that independence which had been acknowledged by Great Britain, in consequence of a representation made by some chiefs who in 1835 had entered into a confederacy by and with the advice and consent of Her Majesty's resident.

Captain Hobson arrived in the Bay of Islands in January, 1840, and immediately issued three proclamations, with only one of which are we at present concerned.

After the preamble, the proclamation in question goes on to say, "Her Majesty does not deem it expedient to recognize any titles to land in New Zealand, which are not derived from or confirmed by Her Majesty; but, in order to dispel any apprehension that it is intended to dispossess the owners of any land acquired on equitable conditions, &c., a commission shall be appointed to inquire into and report on all claims to such lands."

The agreement known as the Waitangi Treaty was subsequently entered into, its principal points being the recognition by the English Government of the "full, exclusive, and undisturbed possession of their lands and estates, forests, fisheries, and other properties which the natives may collectively or individually possess;" on

the other hand, the natives ceded to Her Majesty "all the rights and powers of sovereignty over their territories," and became British subjects.

From this period the difficulties of the unfortunate emigrants commenced. Rich men seldom emigrate. The emigrant classes are persons of no means at all, or persons of small resources, who leave their native land to improve their circumstances.

Picture to yourselves the condition of these wanderers, to whom a parental Government assumed this position— You shall not buy land from the native owners; that privilege we reserve to ourselves. You cannot buy from the white population or from the New Zealand Company with safety, because their titles may not eventually prove sound, according to our views. And as we, the Government, have as yet no land of our own, you must wait until we have purchased from the natives and are in a position to sell. Hence neither old settlers nor new comers were encouraged to commence working the land, for, after the examination of the titles, their labour might prove to have been in vain; they, therefore, passed their time in restless, anxious, expectation, their energies paralysed, their small substance dwindling, until at length, owing chiefly to these absurd regulations, the colony became so distressed that Government debentures were issued for such paltry sums as 10s. and 5s. Surely we need no other proof of the low ebb to which the colony had become reduced.

When the Government was at length in a position to offer land, it was put up in small quantities to auction, on which occasions the officials and a few speculators did much injury to the lasting interests of the colony. True, by this system the price realised was high, and the amount paid into the Government coffers comparatively large, but this was at the expense of a serious diminution of the means of the poorer settlers, who, when they had acquired their dear land, could only send their produce to the same market as the natives, whose land had cost them nothing.

The policy of extracting as much as possible from the newly arrived, for their small plots of land, and leaving them without capital to work with, was suicidal, as the result too sadly proved. Some left the country, but, with the pertinacity of Englishmen, many remained in the land of their adoption, hoping for brighter days. They exported wood, oil, salt pork, maize, and corn to Sydney, and spars for masts (ordinary house timber not paying the high freight), as well as wool and gum to England, and thus raised a credit for themselves.

At length the gold fever broke out in Australia, where agricultural operations were for a time comparatively neglected. Then New Zealand developed its amazing productive powers, and wheat, maize, potatoes, and timber were largely exported to the Australian colonies.

In addition, the colonists turned their earnest attention to breeding sheep, and New Zealand wool is now becoming a large article of export to England, and this antipodal Britain, like its mother, will build its early foundations on the woolsack.

CLIMATE.

The climate of New Zealand is, on the whole, I believe, superior to all others in the world, perhaps I may rank Van Diemen's Land as its equal, for admitting, what I suppose will not be denied, that a moderate temperature is of vast importance in the acquisition and preservation of health; surely, if the maximum and minimum of such moderate temperature are arrived at by slow gradual changes, we have in that circumstance the most favourable element of health so far as the atmosphere is concerned in securing that great blessing.

Some of the southern countries of Europe have a mean annual temperature equally as high as New Zealand, but there is this important fact to be borne in mind, that whereas in the south of Europe the heat in summer prevents out-door labour during several hours of the day, and the winters are comparatively cold, in New Zealand the difference of temperature between the winter and summer months is very limited. Thus the mean temperature of the hottest month of the year in Auckland is 67½ deg., and of the coldest month 51½ deg. In London the mean of the hottest month is 64 deg., and the coldest 37 deg.,—in the one case a difference of 16 deg., in the other of 27 deg. These differences will be more apparent from the following comparative tables:—

MEAN TEMPERATURE.

	Annual.	Winter.	Spring.	Summer.	Autumn.
London	50·39	39·12	48·76	62·32	51·35
Auckland	58·43	50·68	56·82	66·38	59·82
Naples	61·40	48·50	58·50	70·83	64·50

MONTHLY MEAN TEMPERATURE (FROM OTHER OBSERVATIONS).

	In London.		In Auckland.
January............	36·3	July	49·5
February	39·6	August	54·3
March	42·	September.........	54·8
April	47·6	October	58·6
May	55·4	November	58·8
June	59·3	December	64·6
July	62·9	January............	69·3
August	62·9	February	67·0
September	57·7	March	65·1
October	50·8	April	59·
November	42·4	May	56·1
December	38·7	June	52·1
	49·6		59·1

Doubtless, this equality of temperature is in a great measure owing to the insular character of the colony.

The heat of the sun no sooner raises the temperature of the land, and, in consequence, that of the superincumbent air, than the air on the surface of the land rises, and the air from the sea rushes in to supply its place; thus, a refreshing sea breeze is experienced from morning until afternoon or evening, when the land breeze commences, and generally lasts through the night, until a short time after sunrise.

Northerly winds are damp, being charged with moisture; southerly winds bring dry weather.

New Zealand is remarkably free from diseases, complaints of the eye being the only exception, and of this class there are more frequent cases than in England.

Another remarkable peculiarity consequent upon its climate is the fact, that potatoes and maize flourish side by side in New Zealand, contrary to the ordinary condition of vegetation in Europe, where maize will not ripen in the same circumstances as enable potatoes to become perfect. In our own country, for instance, maize has not been, and therefore, I presume, cannot be successfully cultivated, and potatoes are largely grown. In the south of Europe the potato ceases to be generally cultivated, but maize flourishes.

From Van Diemen's Land potatoes are largely exported to the other colonies of Australia, to Sydney particularly, but maize itself is uncertain. On the other hand, maize is extensively cultivated, and with certainty in New South Wales, making excellent food for horses, poultry, and pigs, but potatoes do not succeed so well. In New Zealand they are much prized by the natives, who have large plantations of both vegetables, and a cob of young corn slightly roasted, or boiled and served with butter, is a dish not to be despised.

Physical Geography.

New Zealand is situated about 1,200 miles to the eastward of the great Australian continent, and consists of three principal islands, the North, Middle, and South Island, with several smaller islets; the extreme length being about 1,000 miles, and the width varying from a few miles to 250 miles.

A range of lofty mountains extends throughout the length of both the North and Middle islands, projecting occasional spurs out to the coast, thus giving rise to every variety of scenery; rivers, mountains, and valleys, dense forests and fern plains, silvery beaches, and bold bluffs. The summits of some of these mountains are crowned with perpetual snow, as Mount Egmont in the North island, which rises about 8,600 feet above the sea level; and there are several quite as high in the Middle island.

New Zealand may be properly termed a volcanic country, many of the principal mountains being extinct volcanoes. From Wangaroa, which bears strong marks of volcanic action, passing onwards through the neighbourhood of the Bay of Islands, we come to Auckland, which is situated at the base of an ancient volcano, Mount Eden, the lava or scoria from which is employed as metal for the roads, and as a building material. Starting again from White or Sulphur Island and Whale Island, which are still in action, we pass on to Lake Rotorua, and through the country to Lake Taupo, and thence to Wellington; mud-pools, sulphur and boiling springs abound, and by exposure in some of these, articles may be rapidly silicified.

This part of New Zealand (the province of Wellington) has also been recently subjected to the shocks of two earthquakes; one in October, 1848, and the second in January, 1855, when the ships in the harbour of Wellington appeared to those on board as though grating over a rough bottom, and the houses swayed to and fro; however, as few brick-built houses had been erected since the disastrous earthquake in 1848, less damage was done than might have been expected. Other parts of the colony were but slightly affected, and the shock was not felt at all in the province of Auckland.

No country of the same extent as the colony of New Zealand possesses an equal, or in any way approaching, amount of water-communication; a glance at the map will suffice to show this fact.

If we commence at the northern point, there is the Hokianga, with its six or seven streamlets running 40 miles up into the country, and navigable 25 miles for ships of 800 or 900 tons. This is a thickly-timbered district.

The Kaipara estuary, into which four rivers discharge their waters—the Wairoa, Otamatea, Oruawhara, and Kaipara—also heavily timbered.

The Manukau, into which a better channel has recently been discovered, and, from its proximity to Auckland, promising from its position to be the metropolitan port for the west coast.

The Waikato River, a beautiful stream running through a very fertile district, almost to the great lake Taupo.

Below this is Kawhia, navigable for vessels of 200 tons; and still more to the south is the small stream Wai-te-ra and the romantic Wanganui, at the mouth of which is Petre.

The noble Wanganui, whose origin is at Tongariro, 10,000 feet high, flows in many places through volcanic fissures several hundred feet in perpendicular height.

Next is Port Nicholson, on which stands Wellington, the river Hutt emptying itself into this arm of the sea; and at the head of Palliser's Bay is the fine valley of the Wairarapa, well suited for grazing.

On the east coast is Wangaroa, the scene of the Boyd massacre, the fine harbour of the Bay of Islands, the gulf of the Thames, and various other inlets, giving access to large districts in the interior.

If we turn to the Middle Island, we shall find that numerous rivers intersect the country, although not in the same way, or to the same extent, as in the North Island. The rivers of the Middle Island appear to be more subject to freshes than those in the North Island; the torrents rushing down from the New Zealand Alps, suddenly raise the waters of the streams in the plain, and the water course which may have been easily fordable in the morning, is an impassable gulf at night.

On the deep inlet called by Captain Cook Blind Bay, is the settlement of Nelson, and in the same province, at the head of Cloudy Bay, the fertile valley of the Wairau, the scene of the unfortunate massacre of Europeans which occurred at the early period of the settlement.

Below this, we have the Canterbury plains, and now we get into the more strictly pasture districts of the colony.

The plains of Otako are well-watered by small rivers, giving great facilities of communication and carriage. The province is named from the principal harbour, Otako, an arm of the sea, at the head of which stands Dunedin, the capital.

The southern plains, near Dunedin, afford extensive pasture ranges, which are reached by means of the Molyneux river. The New river, accessible to vessels of 400 tons, opens out a valuable country, and Bluff Harbour is safe for vessels of any tonnage.

The harbours on the west coast, although capable of receiving ships of the heaviest burden, yet from their possessing little available land, and being on the weather side of the island, have hitherto not been much frequented.

I may here notice that nearly if not all the rivers on the western side of these islands have bars at their entrances; hence you will observe that all the European colonists select the east side, which is the lee side of the islands. New Plymouth is an exception, but even its magnificent soil does not cause it to rise rapidly. Attention may also be called, in this place, to the singular circumstance that as we advance from the north to the south, the population diminishes in number, the inhabitants of the North Island being twenty to one on the Middle Island; we also lose that dense forest character which so distinguishes the north. In the North so abundant is timber, that the natives are quite dainty in their selection of firewood, rejecting all but those sorts which experience has taught them are the best for making a pleasant, easily burning fire, whereas in many parts of the Middle Island, in the Canterbury province, for example, so scarce is timber, that the fencing is made by ditch and bank, with a rail at the top sometimes, and it is necessary to grow a plantation as a shelter for gardens and orchards. In a letter from Christchurch, dated October, 1857, I find this statement, "There is not a single tree growing naturally on the plains to be seen, and the high mountain ranges around us are barren."

And although the Struthious genera of birds cannot be said to abound in the North Island, yet they are not difficult to obtain in various parts, but the great denizen of the Middle Island, the Moa, has entirely disappeared. Moreover, the Kauri resin is found on the surface of the ground, at a distance of 500 miles from the district where the tree itself now grows.

Lieut.-Governor Eyre also reports that on a steep high hill on the Middle Island, where now nothing but mosses and lichens grow, were the charred remains of large Totara trees, evidently showing that the ground had once been low and covered with forest.

All these facts point to the probability of some great rising of the Middle Island having taken place within a comparatively recent geological period, and Maui's web of fiction may contain a silver thread of truth.

Animal Productions.

Of the produce of the animal kingdom, I may notice whalebone, and oil—both black and sperm, which for many years formed the most valuable articles of export.

Seal skins and oil also contributed to the export trade of New Zealand, but have now almost entirely ceased.

One peculiarity of New Zealand, I have already observed, was the almost entire absence of land quadrupeds when it was first discovered; all animals have been of European introduction.

Of the native birds, although they abound, a very slight notice must suffice, for they afford no article of export; but one or two species are too singular to be passed over in silence. I allude to the extremely curious *Apteryx Australis*, or Kiwi, which is about the size of a common fowl, with undeveloped wings; a ground bird, nocturnal in its habits, it is perhaps the only bird which is so favoured by the chiefs as to be fairly termed game, all other birds being common. The feathers are highly esteemed for making choice dresses. The other is the Moa, or *Dinornis* of Owen, which was probably the largest bird ever existent on this earth, and stood 16 feet high. The latter is now extinct; the former, although rare, is procurable in several parts of the country. I understand that a Moa's egg has just been found; it is stated to be a foot long, nine inches in diameter, and 27 inches in circumference.*

In passing, I would remark that a moderately good shot need not fear the failure of supplies when travelling, fine large wood pigeons abounding in all the forests, and wild ducks in the rivers; wild pigs are met with in many districts, and in some parts wild goats.

The haliotis iris, mutton fish, is prized by the natives, altough tough eating; the shells are used in constructing the native fish-hooks, and large quantities are brought to England, where the iridescent pearly linings are employed in inlaying papier maché goods.

The growth of wool has, for several years past, been much attended to by the settlers, and New Zealand wool is gradually becoming a valuable article of export. The New Zealand wool brought into the English market in 1857 amounted to 8,325 bales.

One friend of mine wrote to me some time back, saying, "I have recently had a long walking journey, about 270 miles, from Banks' Peninsula (whither I had gone in a schooner) home again to the neighbourhood of Otako. The journey was laborious. During the tour I passed along one of the most extensive grass plains in New Zealand. I suppose, from all I can learn, it is about 250 miles long and 30 miles wide; not a tree to be seen for 50 miles, except the Ti tree. I walked about 150 miles along it, and had to depend upon drift wood for fuel. The country in this neighbourhood is mountainous; the land is principally grass; very little fern." In the North island, which is much more heavily timbered, the cleared lands have been devoted to the growth of cereals rather than to the feeding of sheep, but, in a letter of the 30th September, 1857, I find Ahuriri reported to be the finest of all the sheep districts of the colony, and that the people are wealthy, and their profits every year increasing with the growth of their flocks.

As a very large portion of the produce of New Zealand is sent to Sydney, either for Australian consumption, or *en route* for England, this filtration of its exports through another market before reaching England prevents our having a clear idea of the extent of its capabilities.

I may observe that in those districts which abound in fern, and are not, therefore, so suitable for sheep farming, large pig runs would form profitable sources of income to the farmers, no food producing finer grained meat than fern root, which, moreover, has this advantage, that it does not require any care in the cultivation.

At one time New Zealand pork was in low repute in New South Wales, as being gross and rank. This was, no doubt, owing to the circumstance that the principal portion of the salted pork sent thither came from the whaling stations on the coast, where the animals had been fattened on whale refuse, but fern fed pork is deliciously sweet.

Large numbers of cattle are being imported for stock, and already New Zealand hides are beginning to appear in the English market.

Vegetable Productions.

New Zealand possesses several ornamental woods, very suitable for cabinet makers' use, but probably the freight to England is prohibitory of their employment here; there are also some excellent timber trees for shipbuilding, such as the Puriri, a durable, hard wood, well adapted for knees. Of sixteen specimens sent to Sydney and experimented upon by Captain Ward, of the Royal Engineers, only one was lower in the breaking strain than English elm, fifteen were superior to that timber, several were nearly equal to the best English oak, and two ranked considerably above that wood; one is reported to be represented by a strain of 3001, superior English oak standing at 2037 to 2261 by the same formula.

The forests in the North Island furnish housebuilding timber of various sorts; amongst these the Kauri pine, whose habitât is now the north part of the North Island, although there is no doubt that it once existed in the southern regions. The freight precludes its being profitably brought to this country for housebuilding purposes, otherwise its fine grain, smooth working, and freedom from knots, would soon cause it to take a high position. Its value for ships' masts and bowsprits has long been recognised by the British Government, and many cargoes have been imported; beautiful arrow-like specimens, from 70 to 100 feet in length, tapering from 36 to 40 inches square at the butt to 18 inches square at the head, are not unfrequent, and pieces 50 and 60 feet and upwards in length, without knots, are quite common, and shorter massive bowsprit pieces are easily procurable.

The Kaipara and Hokianga on the west coast, Mercury Bay, the Thames and Wangaroa Harbours on the east coast, are the places in most repute for spars.

From the pine exudes a resin, known as Kauri gum, of which very large quantities are exported yearly. When it first oozes from the tree it is transparent, or at most milky, but exposure to the atmosphere imparts a yellow hue. This resin is not only obtained from the present forests, but is dug from ground where the trees from which it flowed have long ceased to exist. It is used in America in lieu of copal varnish. In this country, I believe, it is chiefly employed as a glaze for calico. The price in England varies much, having been as low as 15s. or 16s., and as high as 80s. per cwt.

All cereals thrive well in New Zealand, and large quantities of wheat and maize are annually produced and exported to the Australian colonies.

Our ordinary fruit trees furnish their ample stores to the southern cultivator, and as we advance northwards, delicious water melons, Cape gooseberries, figs and oranges thrive in the open air, for there an ever-fresh verdure prevails, and the last year's leaves, in a green old age, gradually retire in spring before their more vigorous successors. Some French settlers at Akaroa, in Bank's Peninusla, Middle Island, are cultivating the vine successfully, and in the North Island many varieties have been introduced, principally through the agency of Mr. Busby, who devoted much time and took great interest in the subject. Potatoes and kumeras (a sweet potato, which is at first rather mawkish to the European taste, but in a short time becomes pleasant, and a favourite vegetable) are the staple articles of native food, and these are grown in vast quantities for sale, and shiploads of potatoes in the season are forwarded to Port Phillip and Sydney. It has already been noticed that

* The shell is the 16th part of an inch thick. A hole is drilled in the end of it, and the egg must evidently have been considered of great value, as it was found deposited at the head of a skeleton, with a large number of Pounamu axes.

the maize and potato flourish side by side in this antipodal Britain.

The Phormium tenax (New Zealand flax) is a hardy plant, belonging to the natural order of lilyworts; and although popularly termed flax, the plant from which it is obtained differs entirely, and in almost every respect, except that it is a plant, from the European flax and hemp. The following Table, showing the botanical differences, may render this statement more plain:—

	Class.	Order.	
European flax...	Exogens ...	1*	Fibre from the stem of the plant.
,, hemp	Exogens ...	2†	Fibre from the stem of the plant.
New Zealand flax	Endogens ...	3‡	Fibre from the leaf of the plant.

There are several varieties, some yielding finer, others coarser fibres, and but little care has hitherto been given to the selection of the most suitable for manufacturing purposes in England, but if the difficulties of preparing large quantities could once be overcome, and attention drawn to the necessity and advantage of selection, the cultivation of the superior kinds only would be encouraged.

Warmth and moisture appear to be the principal requisites for its flourishing. In New Zealand it grows on the hills and in the valleys, but seems to thrive best in the latter situation.

In the *Gardener's Chronicle* of the 12th December 1857, Mr. Saunders, of Jersey, states that he has a plant of the *Phormium tenax* which, in 1855, produced one flower stem 10 feet long; in 1856, ten flower stems averaging the same length, and in 1857, seven flower stems of the same length, the diminution owing to deductions having been made from it for the purposes of propagation. The position was moist, and exposed, with a westerly aspect. "The leaves," he says, "vary from five to eight feet in length, and we sometimes strip them off and make use of them as tyes, which are particularly tough and strong. If these leaves are kept for two or three years, they may at any time be made pliable by steeping in water, and made as useful as if they had been taken from the plant but a few days."

The New Zealanders use it green in strips for tying and joining in every shape, the article being a convenient substitute for nails, string, pins, and all connecting implements, and in its green state it is also used largely for plaiting baskets to hold potatoes, and cooked food is generally presented to chiefs and visitors in new flax baskets, about the size of a mechanics' paper cap. When prepared it is used in the manufacture of all kinds of garments, in the making of lines for fishing, ornamental baskets for small wares, and floor mats. It is sometimes dyed of various colours to confer additional beauty on the articles into which it is manufactured.

The native mode of separating the fibres from the dense mass of fleshy parenchymatous matter in which they are embedded is by means of a cockle-shell, and by a gentle pressure the shell is repeatedly drawn or combed along the leaf, and gradually the fibres appear in long and beautiful delicate silky threads. Doubtless, this is not an economical mode of preparation, a large per centage of really valuable fibre being combed away and discarded, but no European mode of proceeding has hitherto been found to accomplish the object so successfully.

I may explain that the old careful preparation of flax by the natives is almost dying out; they can obtain European good clothing at so cheap a rate, and their time can be employed to so much greater advantage in other pursuits. Several European plans have been tried, but none as yet have been attended with any marked success.

A friend of mine, writing from Auckland, on the 30th September last, says, "I am afraid nothing will come of Whytlaw's flax. Five tons in six months will not pay his staff of men and boys, but I think we shall have some flax ere long to export;" and then he refers me to some specimens prepared by the Baron de Thierry's process of steaming.

Another Auckland resident, Mr. Cox, appears to have been trying his skill in preparing the flax for manufacture and exportation. It is stated that the machine is very simple, being based on the principle of the carding machine. A subscription was at once started to cover the expense of preparing five tons of flax for shipment to England; it is also stated that the natives present at the trial of the machine wanted to purchase it on the spot. On this occasion, the motive power was by hand-labour, but even this showed a result of 3 cwt. per frame or machine per day, and with steam power there would be nothing to prevent a hundred frames or machines being set at work under one roof. This experiment was made in the presence of several of the most influential colonists, who, on the same occasion, entered into a subscription for defraying the expenses of a public trial of the Baron de Thierry's mode of preparing flax. I also learn by recent news from Auckland, that nearly £1,500 has been subscribed towards the formation of a flax company.

So important has this question been deemed by the Colonial Government of New Zealand, that it notified on the 20th Dec., 1856, that the following rewards would be paid for certain inventions or improvements connected with this article,* viz.:—

£2,000 to the person who shall, by some process of his own invention, first produce from the Phormium Tenax, or other fibrous plant indigenous to New Zealand, 100 tons of merchandize.

£1,000 to any person, other than the person entitled to the first reward, who shall by some process of his own invention, next produce from the Phormium Tenax, or other plant indigenous to New Zealand, 100 tons of merchandize.

£1,000, viz., £200 to each of the first five persons, other than those entitled to the first and second rewards, who shall by any process, whether his own invention or not, produce from the Phormium Tenax, or other fibrous plant indigenous to New Zealand, 25 tons of merchandize.

Half the reward to be paid upon the Governor being satisfied that the applicant is entitled to the same, and the other half on proof of the *bonâ fide* sale of the merchandize in Europe, at an advance of 20 per cent. on the actual cost of the article landed in Europe. Every claim for reward to be preferred before the 1st January, 1859.

The importance of this subject to the mother country will be apparent, from a consideration of the immense quantities of flax and hemp imported yearly into England. These were—

Flax, dressed and undressed.

Quantity in 1855.	Value in 1855.	Quantity in 1856.	Value in 1856.
1,293,435 cwts.	£3,317,122	1,687,041 cwts.	£3,627,507

* 1. European flax (Hypogynous exogens), geranial alliance. Symmetrical flowers; styles distinct; seeds with little or no albumen.

† 2. European hemp (Diclinous exogens), urtical alliance. No albumen; unsexual.

‡ 3. New Zealand flax (Endogens), lily alliance. Styles consolidated; hypogynous, bisexual, hexapetaloid; copious albumen.

* See *Journal*, Vol. V., p. 328., and Vol. VI., p. 137.

HEMP, UNDRESSED.

Quantity in 1855.	Value in 1855.	Quantity in 1856.	Value in 1856.
1,276,678 cwts.	£1,918,816	1,504,726 cwts.	£1,935,873

And yet one of our own colonies porduces an inexhaustible supply of an article which, according to Dr. Lindley, is stronger than those so largely consumed materials, the comparative strength of various fibres being thus stated by him :—

Silk	34
New Zealand Flax	$23\frac{4}{5}$
European Hemp	$16\frac{1}{3}$
European Flax	$11\frac{3}{4}$

I must add that, although the flax is admitted to be exceedingly strong in the straight pull, it is stated to cut in the tie; whether this arises from a serrated edge of the fibre, or from a brittleness produced by the presence of the gum and chemical salts, as phosphate of lime, &c., which the flax naturally contains, further experiments can alone determine. Certainly the flax imported during the last 15 years cannot be regarded as fairly representing what the article is, so rough and unprepared have been most of the specimens I have seen.

The plant contains a curious gum, of which I had a sample sent over for the purposes of experiment, but so anxious were our customs officers to ascertain whether it contained a liquid liable to duty, that the bottle was broken in the process of ascertaining the point, and the contents spoiled.

MINERALS.

COAL.—This valuable substance has been found cropping out in various parts of the country, in some of the southern ports of the North Island, also in the provinces of Nelson and Canterbury. It is being worked on the surface, I understand, but the quality is not, so far as I can learn, of any very great excellence.

COPPER.—A considerable quantity of copper ore has, at various times, been imported from New Zealand, principally by way of Sydney, obtained from the Great Barrier Island. I believe the works are not being carried on, whether from the yield not being satisfactory to the proprietors, or from any other cause, I am not aware.

The Dun Mountain Company propose mining in the province of Nelson. Two tons of ore extracted from the lodes they propose to work, were dressed for market at Swansea. This parcel is stated to have yielded, after dressing, $23\frac{7}{8}$ per cent. of fine copper, and the refuse dust produced $6\frac{3}{4}$ to $13\frac{5}{8}$ per ton of ore, which consists of a grey sulphuret, with red and black oxyde and native copper, and strong yellow sulphuret. A staff of miners, with suitable implements for carrying on the works, have been despatched to Nelson, and, by this time, are expected to be at work.

GOLD.—The sudden elevated position taken by Victoria on the fact of its gold fields becoming known, naturally led the neighbouring colonies to look at home, and, if I may so say, "sweep diligently the house." In Van Diemen's Land gold was discovered, although not in sufficiently remunerative quantity, and New Zealand soon proved that it also possessed the precious metal.

The Coromandel Harbour was the first district which the colonists ascertained to contain gold, but, although a large reward was offered by the Auckland merchants for proof of its affording a reasonable compensation to diggers, the necessary evidence to secure the reward was never forthcoming. The province of Nelson, however, in this matter, as in the case of copper, seems likely to claim the palm. Already 2,000 diggers are diligently at work devoting themselves to the search for gold, and have agreed to regulations amongst themselves. Their search appears so satisfactory that many are leaving the other provinces to join in the gold hunt.

DIVISION INTO PROVINCES.

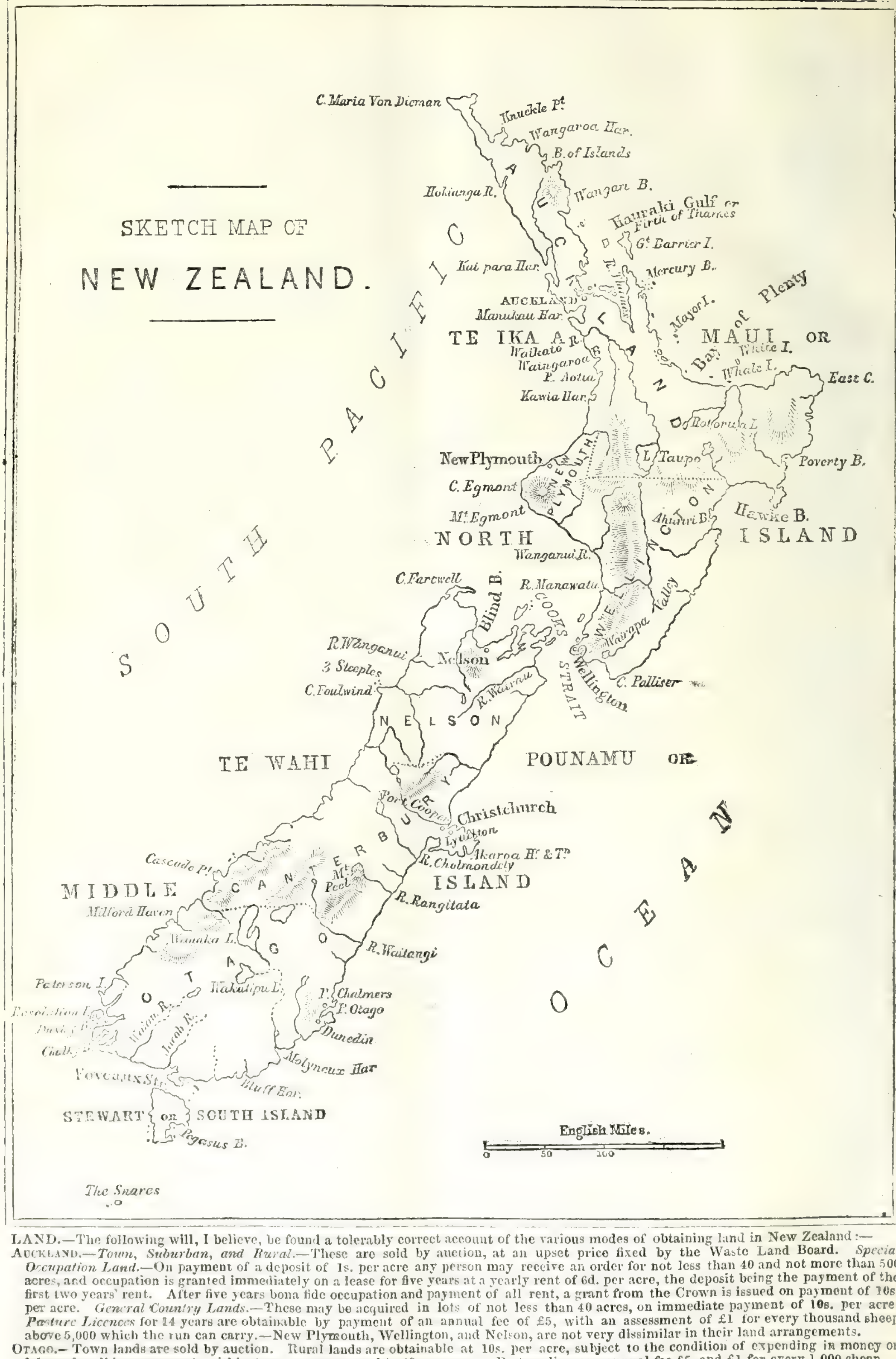
By an Act of Parliament, 15 and 16 Vic., cap. 72, a constitution was granted to the colony, the legislative powers being vested in a General Assembly, consisting of the Governor, and Legislative Council and House of Representatives, for the whole colony; the minor local affairs of the six provinces into which the islands were divided being placed under the management of a Superintendent and Provincial Council for each. These provinces are Auckland, New Plymouth, and Wellington in the North Island, Nelson, Canterbury and Otako in the South Island.

The North Island, as has been stated, contains a comparatively large native population, which circumstance, although advantageous in some respects, from other points of view has its difficulties. Labour is thereby more easily obtained than in an unpeopled country, and in the natives we have a very large productive and consuming power, all desirable in a commercial aspect of the question. As a simple but pregnant illustration of the importance of the native element in all considerations affecting the three northern provinces, especially Auckland, I may state, that in the year 1855, the vessels registered at, or belonging to, Auckland, consisted of three steamers, 41 foreign going vessels, of 6,618 gross tonnage, 75 coasters belonging to English owners, 49 coasters belonging to native owners, besides which there were 158 small craft, averaging 10 tons, of which 34 belonged to native owners. Innumerable squadrons of canoes, from 10 to 70 feet in length, some capable of carrying many tons of produce and sixty or seventy persons, are not included in this account. These vessels may probably bear about the same relation and importance to the other properties and operations of the natives, whether of farming or dealing, as in other countries.

Yet it was in reference to men capable of this development, that a Committee of the House of Commons passed a resolution to deprive them of all waste lands not actually occupied; contrary to the express agreement of her Majesty's Representative with the chiefs, in the hearing of myself and many other Europeans.

The resolution was not carried out, and the natives remain the proprietors of the land in the North Island, except so much as, in accordance with the Waitangi treaty, may have been purchased from them by the government, and hence those extensive districts are not open to the occupation of Europeans, as is the case in the Middle Island, where the native population being extremely small, there is a more free field for European colonization.

The northern province is Auckland, at present the most important, being the seat of government, and having the largest European and native population. The numerous rivers in this province have caused a considerable coasting trade to spring up, and about a thousand vessels, including coasting craft from 10 tons and upwards, enter the port of Auckland yearly. Small farms are easily obtainable, with good soil and healthy climate, and the means of comfortable living are procured with such facility, that an old resident has said,—"A working man thinks it hard if he cannot have meat on his table three times a day, and further adds, "A beggar would be a novelty." A friend, who has lived in different parts of the islands, both in the extreme north and in the south for twenty years, and who resided in the New Plymouth District for several years, says,—"Taranaki is decidedly one of the finest districts, the land being so excellent, but there is no harbour, and the roadstead is dangerous." And Governor Grey says, "I have never in any part of the world seen such extensive tracts of fertile and unoccupied land as at Taranaki." On the whole, this province justifies the high praise the natives have ever bestowed upon Taranaki as being the choice garden of the island. It is more suitable for agricultural than pastoral pursuits, and for small farmers is not surpassed by any other place



LAND.—The following will, I believe, be found a tolerably correct account of the various modes of obtaining land in New Zealand:—

AUCKLAND.—*Town, Suburban, and Rural.*—These are sold by auction, at an upset price fixed by the Waste Land Board. *Special Occupation Land.*—On payment of a deposit of 1s. per acre any person may receive an order for not less than 40 and not more than 500 acres, and occupation is granted immediately on a lease for five years at a yearly rent of 6d. per acre, the deposit being the payment of the first two years' rent. After five years bona fide occupation and payment of all rent, a grant from the Crown is issued on payment of 10s. per acre. *General Country Lands.*—These may be acquired in lots of not less than 40 acres, on immediate payment of 10s. per acre. *Pasture Licences* for 14 years are obtainable by payment of an annual fee of £5, with an assessment of £1 for every thousand sheep above 5,000 which the run can carry.—New Plymouth, Wellington, and Nelson, are not very dissimilar in their land arrangements.

OTAGO.—Town lands are sold by auction. Rural lands are obtainable at 10s. per acre, subject to the condition of expending in money or labour for all improvements within 4 years, a sum equal to 40s. per acre. Pasture licences, annual fee £5, and £1 for every 1,000 sheep.

CANTERBURY.—Town lands by auction. Rural lands, 40s. per acre. Pasture licences, £1 per 100 acres.

on the globe. Taranaki is the native name for the district of New Plymouth.

Wellington and Nelson were founded by the New Zealand Company, and after many vicissitudes and troubles from various causes, are gradually rising to wealth and importance. Sheep farming has been extended, and the export of wool is assuming large proportions.

Of late gold has been discovered in the province of Nelson, and some settlers, I find, are leaving Auckland for the gold district. There has not been sufficient time to test the value of the diggings, and I trust they will not be so encouraging as to draw off the colonists from the steady pursuit of the more certain, though more slow, rewards of agriculture. For, however successful gold diggers may be, they are consuming capital as well as interest, whereas, in farming or sheep-breeding, generally speaking, more is yearly left on than is removed from the land, and in this view I am not certain whether, if all the gold diggers had devoted themselves with equal energy to ploughing and sheep and stock breeding, they would not have been quite as rich on the whole as they now are. Still there are "high pressures" among us to whom the exciting digging life is the most suitable industry, and to whom the humdrum round of farming and sheep-keeping would be unendurable, and so we wish them God-speed.

Canterbury and Otako are rapidly advancing to affluence, these provinces being eminently adapted for pastoral pursuits.

The gentleman to whom I previously alluded writes to me in reference to this part of the country: "The country generally is well adapted for sheep and cattle runs (my friend came from an English grazing country), also very good for cultivation, and I have little doubt but that when these settlements are fairly set going, they will soon be flourishing, especially for the grazier. The climate is much the same as some of the south parts of England, and appears to be healthy for European constitutions; the health of ourselves and family has been better here than it has been since we left England."

Emigration.

To intending emigrants I would point out New Zealand as offering to industry, easy competence, gradual improvement, and eventual affluence; not so rapidly, perhaps, as in some other colonies, but without their drawbacks. If you are farmers, and a good productive soil and delightful climate be your desire, then gratify your wishes by settling in the northern provinces; if to be rich in cattle and sheep be your ambition, seek its accomplishment in the southern provinces. If hale and strong, you have nothing to fear from the vicissitudes of the seasons, for to Englishmen the provinces are all mild; if delicate, seek the retention or restoration of health by settling in the northern provinces. If mechanics, you will probably find a larger sphere in the more peopled districts, as at Auckland, Wellington, or Nelson. But whatever you purpose, or whichever place you may select, go with a resolute brave heart, determined to stay, to spend your life in your adopted country. Leave nothing behind, but, converting all your properties into cash, remit the money through one of the two respectable banks which have branches in New Zealand, either the Union Bank of Australia, or the Oriental Bank Corporation. Carry nothing with you save a good stock of personal apparel, and under no circumstances whatever be persuaded to burden yourselves with furniture, except a chest of drawers, and still less be coaxed into the purchase of goods for sale, for recollect there are always supplies in Sydney ready to be poured into the New Zealand market within a few weeks of the special want arising; besides that, the merchants at all the principal ports have correspondents in England, who are only too ready, by the very first opportunity, to supply, in any quantity, whatever may be required. By the possession of cash, you would be enabled, in many cases, to purchase advantageously farms upon which much labour had been expended, the occupants desiring to remove, to retire altogether, to enter upon some other business, or leave the colony, and in arranging with such, the circumstance of receiving immediate cash is a great consideration. Nor is it of trifling importance that you should enter upon a partially cleared and ready tilled farm, rather than undergo the tedious hard labour of commencing everything anew for yourselves,—only those whose eyes have swept over miles and miles of forest and fern for days together, can appreciate the hope and joy that spring up at the sight of a little cultivated patch, however small, even a few yards square.

Communications with this Country.

Nor in speaking thus of the emigrant proposing to himself a final farewell of his native land, I do not at all discourage the idea of his often communicating with the dear old country; so frequently do the opportunities now occur that one can no longer expect a settler to jump for joy at a letter from home, and read with avidity, and interest next to his bible, an old newspaper from England.

It is less than twenty years since the first merchant ships began to sail regularly direct from England to New Zealand; previous to that date, the circuitous route of sending goods to Sydney, where they waited an uncertain time for a small vessel to convey them to New Zealand, was the only course possible. Vessels of considerable size now depart about once a fortnight to one or other of the chief ports, and so direct communication one way, outward, is tolerably frequent, but the export trade has not yet enabled us to have any regular communication from New Zealand; letters still come by way of the Australian colonies.

When the Peninsular and Oriental Company ran their steamers to Sydney with the English mails, correspondence with New Zealand was regular, the New Zealand government having subsidized a steamer to run monthly in conjunction with that line. On the removal of the steamers at the time of the Crimean war, the communications became extremely irregular, the arrival of the outward mail from England being uncertain, inasmuch as letters were sent from this country by sailing vessels to Melbourne, whence they were transmitted by a steamer to Sydney, and thence forwarded on to New Zealand by the contract steamer *William Denny*. On the new Australian contract being taken, it was hoped that regularity would become the rule, but we have been doomed to miserable disappointments; almost on the first voyage, under the new arrangement, the inter-colonial steamer was wrecked near the North Cape, and has not yet been replaced, therefore intelligence has at present to be conveyed to and from Sydney and New Zealand in sailing vessels, and when thus far on their journey, the irregularity in arriving and departure, and the utter inefficiency of the new Australian mail service, render all calculations unavailing. No one should just at present reckon upon his letters until actually in possession.

A brighter prospect is, however, opening before the colonists in this respect—the Royal Mail Company having entered into an arrangement by which, in the course of a year or so, a monthly communication, by way of Panama, will be opened between this country and New Zealand; a line of steamers will be placed on the Pacific to run in conjunction with the West India vessels. As New Zealand will be their first port of arrival in the Colonies, and the last of departure, the intercourse will be altogether different from the present, and as this line will be in addition to the Eastern mail line, we may thus hope to have a fortnightly service, and when the submarine telegraph system shall have laid its girdle round the earth, I do not despair of the possibility, in the lifetime of some present, of our being able to pay a bodily visit to our antipodal friends in 40 days, and to flash the thought divine in 40 minutes.

DISCUSSION.

Mr. P. L. Simmonds said, the subject which had been so clearly and connectedly brought before the members by Mr. Stones, was a very important one in view of the emigration which was daily taking place, and it had been presented free from all bias or undue partiality. Having for a long series of years paid a special degree of attention to the British Colonies and their resources, and New Zealand having recently been prominently before him, he might add some corroborative opinions to those advanced by Mr. Stones. Firstly, however, he would remark that he was delighted to find the Council paying a due proportion of attention, among numerous other subjects, to colonial interests—for the programme of papers to be read contained several—and the discussions upon these were calculated to benefit home interests, as well as the colonies themselves. Only that very morning he had been looking through a series of interesting New Zealand specimens sent him by his brother, a paymaster in the Navy, who had recently returned from that colony, and who spoke highly of the climate and capabilities of the New Zealand group, and that from an experience of several years, while attached to H.M.S. *Pandora*, surveying the New Zealand shores. Only a week or two ago also, in a business letter he had received from a correspondent at Auckland, dated Oct. 28, occurred these words:—"I have been ranging the colonies. After leaving Van Diemen's Land I was for nearly four years a resident in Sydney, visiting Adelaide, Melbourne, Wellington, and other places. I am now, I incline to think, finally settled in Auckland, where, thank God, I have been for the last nine years, sound and hearty as ever, and here I am likely to become a fixture. I consider New Zealand the flower of all the colonies, and I am happy to say I have not been unsuccessful in founding a home in her." When they considered that New Zealand was almost the youngest of Britain's colonies, her present position was a remarkable evidence of industrial progress, achieved, too, in the face of many adverse difficulties, despite the pet colonizing projects and schemes which had been carried to a certain extent and then dropped. But the indomitable energy of the settlers, thrown upon their own resources, with the natural advantages of a good climate, ample room for extension and progress, and steady perseverance, had achieved a present success which would compare favourably with any other British possession. When it was remembered that it was scarcely 17 years ago that the first settlements there were formed, with all the counter attractions of the Australian gold fields, and with the disadvantage of a long and expensive passage, which induced many thousands yearly to take the shorter voyage across the Atlantic, we yet found a European population of 40,000 settled in New Zealand, six distinct settlements formed on the Northern and Middle Islands, and flourishing towns dotting the coasts on either side from south to north. The revenues of New Zealand now amounted to nearly a quarter of a million; her customs duties bringing in £100,000, and her land fund about £80,000 to £90,000. And it was extremely satisfactory to find that the land was now open to the selection of small settlers at a reasonable price, instead of being only available at exorbitant rates in large blocks, as was formerly the case. While the Canterbury Company fixed the price of land at £2 and £3 per acre, land could now be had for 10s. an acre, and from the judicious arrangements of the provincial governments, a remission of the passage money, or, at all events, a commensurate allowance in land, was in many instances being made. He held in his hand an official announcement from the Immigration Department of the province of Wellington, dated the 11th August, by which it was notified that every immigrant would be entitled to receive ten acres of land for every £20 he should have paid on account of the passage of himself and family. Now this was a boon calculated to counteract, in some degree, the partiality evinced for Canada, where free grants of land were given to settlers in some districts, but in a much more severe climate. Although, as was remarked by Mr. Stones, the principal portion of the New Zealand trade was an inter-colonial one, and she sent large supplies of timber, agricultural produce, &c., for transhipment or for local consumption to the Australian ports, still we found that the value of the direct imports from New Zealand in 1856 were about £101,000, and the shipments of British produce and manufactures and foreign goods thereto, from the United Kingdom, amounted to about £300,000 in value. Mr. Stones had incidentally mentioned most of the indigenous productions of the colony. He (Mr. Simmonds) believed, however, much yet remained to be done with many of these; her fibres, her minerals, her building and furniture-woods, her dyes and tanning substances, the Kauri gum, (of which she now shipped 20 or 30 tons) and other produce, if not for export at least for local use and manufactures. With respect to her gold fields, injurious as these were, to some extent, as distracting attention from more settled industrial pursuits, still this disadvantage was counterbalanced by the thousands of restless spirits which they drew from other quarters, and who mostly settled down eventually, when unsuccessful in gold-finding, to other pursuits. Looking at the present discoveries, and judging from the geological formation of the islands, which no doubt at one time formed part of the great Australian continent, it was very probable that more important auriferous deposits would yet be found. Even the two gold fields already being explored were by no means insignificant, since, from one field at Aorari, the last steamer had brought 600 ounces to Nelson. But the extensive diffusion of gold through the Coromandel ranges, within 40 miles of the city of Auckland, appeared now to be established. Thus the Auckland *Weekly Register* of Oct. 5, in an article on the goldfields, active and passive, stated:—"Hundreds of ounces, under the greatest difficulties and discouragements, have been *known* to be obtained there; but who is there can tell the quantity that has been steadily and *silently* gathered by a few persevering hands? Samples upon samples of scale gold, and specimens after specimens of a sort of fawn-coloured quartz, actually studded, not streaked, with the precious metal, have from time to time been exhibited. From eleven ounces of such quartz Mr. Vercoe obtained seven ounces of gold. Other experiments, by Mr. Keven and others, have not been less encouraging; and yet, with all these incentives, with all these challenges to dig and grow rich, Coromandel is still as much overlooked as if her ridges bore nothing more precious than scoria or pumice-stone! These remarks have been drawn from us in consequence of a further and remarkable authentication of the great riches of Coromandel by the receipt (by the *Maid of the Mill*) of some beautiful specimens of quartz completely impregnated with the shining metal. We have the authority of gentlemen fully informed on the subject, for stating that this quartz was broken off a vast mass of the same material now in process of being crushed. This, we think, is one very sufficient reason why the Coromandel gold fields should no longer be suffered to remain unproductive." Another Auckland paper, the *New Zealander*, of Oct. 14, stated, with respect to Coromandel gold, "Mr. W. Wilson, whom many of our readers may remember as formerly in business as a baker in this city, and who resided for seven or eight years in California, has this day brought for our inspection a fine sample of gold, which he has just obtained in the neighbourhood of Messrs. Roe and Street's saw mill. He further states that in the course of a hasty prospecting visit, he saw enough to convince him of the richness of this neglected gold-field, which he considers quite equal to anything he met with during his stay in California, where, for five years, he was constantly at the diggings." The other provinces were put on their mettle by these discoveries, for at Otago a public meeting had

been held to provide, if possible, a counter attraction in the form of a remunerative gold field, so as to prevent the departure of the new immigrants arriving, and it was broadly asserted in the resolutions that "the existence of gold in certain districts of the province is a well-ascertained fact, and it therefore behoves the provincial government to take active and immediate steps for ascertaining the localities where its working would prove remunerative." Passing next to its principal staple, the wool shipments, we found that, while only 487 bales were shipped from New Zealand in 1849, our imports thence in 1857 reached 8,325 bales. It was stated by one of the members, in a Wellington paper, that that province, out of its 10,000,000 acres, had about 4 or 5 millions fit for pasturage in their natural state, and these, at the rate of 1 sheep to 3 acres would yield 13,000 bales annually, worth about £200,000. If improved and cultivated, however, the pasturage would probably feed 6 sheep to the acre. But this was only one district. The province of Auckland could not be surpassed as a wool growing district, either as to quality or quantity from each sheep. One of the first wool-brokers in the City had remarked, that when the first specimen of New Zealand wool was brought to him by some gentleman unknown, without saying whence it came, and his opinion being asked of it; after examining it carefully, he replied, "Whatever country that wool comes from must be a sheep's paradise." He had since stated that there were some peculiar and very valuable qualities in the best New Zealand flocks, and as for strength of fibre, it was "as tough as their native flax." He would say nothing as to hides, cattle, and other agricultural produce, but he was glad to notice that the Chinese and African sugar grasses (species of *Holcus*) had been introduced, and their cultivation might possibly be attended with beneficial results, and lead to the production of sugar for local consumption. These grasses, which had been introduced largely of late into Europe, Canada, and the United States by his friend Mr. Leonard Wray, a Natal colonist, possessed those beneficial properties, that they would ripen and yield sugar in temperate climates, and come to maturity in three or four months, whereas the sugar-cane took twelve months or more before it yielded a crop. There was one index which afforded a better criterion than almost anything else of the position and prospects of a colony, and that was the nature of its newspaper press. Receiving as he did, regularly, all the New Zealand journals, he learnt more of their condition and progress, their wants and grievances, than could be gleaned elsewhere. Now, when he told them that there were 18 or 20 newspapers now published in the New Zealand islands, newspapers, most of which would do no discredit to the metropolis or the large provincial towns, whether as regarded their typography, paper, or conduct, this was a remarkable index of progress. Several of these papers were issued twice a-week, full of business advertisements, appearing at Dunedin, in Otago; at Lyttelton, in the Canterbury settlement; at Nelson and Wellington, in Cook's Straits; at Taranaki, in New Plymouth; at Wanganui; at Ahuriri, in Hawke's Bay; and at Auckland. Now, this was a state of things which compared favourably with any other British colony, and he could not but contrast it with the time when, in the infancy of the colony, a friend of his, who conducted a journal issuing from the Government printing-office at Auckland, had the permission to print there withdrawn, owing to the freedom of his remarks against the Executive, and after collecting all the stray type that could be obtained, was driven to the shift of printing his paper by means of a mangle, as there was no other press in the colony. He (Mr. Simmonds) had laid copies of all the principal New Zealand journals on the table, and the members and visitors who were not in the habit of seeing those colonial papers, could form an opinion of their business character for themselves. He found he had already taken up a large share of their time, and as he saw present Mr. Ridgway, Mr. Sidney, and other gentlemen, who could give them much valuable information, he would now give way to them.

Mr. Ridgway said although he had never been in New Zealand, yet he felt a deep interest in that colony, having been officially connected with it for a great number of years, and his name would be found in connection with its earliest establishment, particularly with regard to the province of Auckland. Mr. Stones, in his very able paper, had given them a rapid sketch of this rising colony, but there were some points of importance which he had omitted. First of all there were the questions which agitated, and, in fact, retarded the progress of the colony to a great extent. He alluded to the political discussions and the jealous contests between the provinces of Auckland and Wellington, as to which should be the seat of government. Peculiar circumstances tended to make Wellington a province, but he would appeal to the shippers to New Zealand whether the difference in the rates of insurance as between Wellington and Auckland was not a fact in favour of the latter. The port of Wellington had many disadvantages. The winds blowing through Cook's straits during the greater part of the year caused great difficulty in navigating them, and when vessels arrived at Wellington the landing was often difficult and dangerous, and they were also locked in. The high lands which surrounded Wellington prevented ready access to the interior. The timber in the neighbourhood of Auckland was extremely valuable, the trees growing to an enormous size. At the Paris Exhibition unfortunately there was no means of properly testing the quality of the timber sent, because the specimens were too small. The contributions from this colony were meagre in comparison with what they might have been had not the colonists considered themselves somewhat slighted at the Great Exhibition of 1851. With regard to the Coromandel gold fields, he was not sufficiently acquainted with the subject to be able to speak upon it, but his impression was that that district did not belong to the British crown, but still remained a part of the native possessions, and until it became British property it was not likely our people would expend much money in prospecting upon that place, though unquestionably there were valuable gold fields there. With regard to the article of coal, he had been assured that it existed in great abundance in New Zealand, but the great difficulty was in working it, on account of the scarcity of labour. From all he had heard it was of good quality, and it was well known that the lower they worked for coal the better the quality was. With reference to the Kauri gum, it was a valuable production, in great plenty in the colony. With regard to the facilities for exporting products from New Zealand, they were not so great as those which were possessed by other and less remote colonies, inasmuch as the ships which took out emigrants went to China or India for their return cargoes. Reverting to the subject of the scarcity of labour in the colony, he was happy to say that he had recently despatched by the ship *Egmont*, 60 or 70 labourers, promising men, of good character; and the advantages of emigration to Auckland consisted in the arrangements of the provincial government, of which he (Mr. Ridgway) was the agent, who paid one-half of the expenses of the emigrant's passage, leaving him to pay the other half six months after his arrival in the colony. It was a mistake to pour in large numbers of emigrants all at once. They had instances of 6,000 or 7,000 emigrants being poured into Melbourne in the course of one week, and under such circumstances it was impossible but that the labour market should be overstocked, and hence much disappointment and misery resulted. Whilst speaking of Auckland as possessing undoubted claims to the seat of the government, he would refer to Nelson, Otago, and other places in the colony, as being most desirable for those who went out with large families. The most important point, perhaps, in connection with this subject was the

means of regular and speedy communication with our Australian colonies, especially by way of New Zealand. He had always contended that the Panama route, by way of New Zealand, was the right one. With reference to the sale of land in our colonies, in his opinion the disposal of it in small allotments was of the greatest advantage to the emigrant, because it prevented jobbery in land. Every one could obtain small plots of land in New Zealand at 10s. an acre. The government bought it at about 7d. per acre, or even less for large blocks, and the profit made by the sale of the land went to help poor persons in their passage to that colony, and thus employment was given to our ships, and markets were created for our home manufactures.

Mr. William Hawes said it appeared to him that the most important part of the paper was the placing before them, in well-arranged and consecutive form, information which would enable intending settlers to determine which of our many colonies they would select. The great point was to know whether particular colonies were capable of producing those commodities which were in greatest demand at home, and then they could select the destination which appeared to hold out the greatest chances of benefit to themselves and their families. The great staple productions of New Zealand might be regarded as timber, wool, and gold, and to these this country would attach greater importance than to any others. He could not go to the extent of saying that gold digging ought to be deprecated, for who could say what would have been the position of the commerce of the world in general had not our supply of gold been largely increased by the discovery of the gold in Australia and California? Therefore, let them not deprecate the search for gold on the ground that it ate up capital. Labour was given in exchange for gold, and the gold was exchanged for the manufactures of this country, and a beneficial system was thus established. It was quite clear that the object of the paper that evening was to prove that New Zealand offered greater advantages to settlers than any other colony. Whether it would be successful in that he could not say, but it could not be denied that much valuable information was given, which would greatly help in deciding the question as to the quarter which one would choose as his ultimate destination, and it might be a question with many whether New Zealand had not great claims for preference over many other colonies that had up to the present time been more highly favoured.

Mr. Samuel Sidney said that in the course of the many years that he had devoted his attention to colonization, he had never heard a paper on the subject of New Zealand which was so full in its details and, at the same time, so free from the exaggerations which had hitherto almost invariably characterised everything written or spoken by the friends of that interesting colony. New Zealand afforded a striking example of a colony spoiled by over-praise, over-regulation, and over-legislation. It reminded him of the child of the anxious mother overwhelmed with tutors and doctors, and yet, with all her pains, neither clever nor healthy, and on appealing to a woman of common sense, she recommended the trial of "a little healthy neglect." Twenty years had elapsed since the colonization by the great defunct company at one end, and the Government at the other, commenced; until the company fortunately became bankrupt, and the government, about the same time, allowed colonists to manage their own affairs. New Zealand was the subject of a series of experiments in colonization, each more disastrous to the colonists and more costly to the mother country than the last. Models of colonization were promised in Wellington, in Nelson, in New Plymouth, in Otago, and in Canterbury, examples of slices of English civilized society, capitalist squires, respectful and cheap labourers concentrated round cities, with churches, schools, colleges, and macadamized roads. But all had ended in the ruin of the emigrants, who only began to succeed when they followed the example of unsystematic colonists, and allowed labouring men to cultivate cheap plots of land, while men of money betook themselves to dispersion and sheep-feeding. He had calculated that as much money had been spent in Blue Books, Naval Books, Reports, &c., on New Zealand, as would have paid the whole cost of governing Port Philip up to the time that gold digging commenced there. The successful colonization of New Zealand, described so effectively by Mr. Stones, had been worked out by those who, disappointed or ruined, could not or would not return, and, therefore, with a true Anglo Saxon spirit set to work with the happy results which they had had the satisfaction of hearing that evening. Ten years ago (the last time in 1850, at the great meeting of the Canterbury colonists) he (Mr. Sidney) had contended, in opposition to many influential men, that only on a low-price system of land allotment could New Zealand flourish, and now he had the satisfaction of finding that the local legislature had been forced to repeal the laws of the English parliament and the rules of the New Zealand Company, and adopt his once unpopular views. Having said thus much by way of preamble, he would venture, in the most friendly spirit, to dissent from two or three of the opinions that had been laid down that evening. Mr. Stones had very modestly referred to all the productions of New Zealand with the exception of the great staple wool; to that he appeared very wisely to give the palm of importance. He had suggested that emigrants of small means and strong arms should apply themselves to the cultivation of the not very expensive or accessible parts of the naturally fertile soil, whilst those of large means should direct their atttention to pastoral pursuits. His friend, Mr. Simmonds (of whose zeal in placing before the public the raw productions of various quarters of the globe it was impossible to speak too highly), had been, he thought, a little too enthusiastic in the stress he had laid upon the manufacturing and mining products of New Zealand. He (Mr. Sidney) thought, in the course of time, New Zealand colonists, with more capital at command than they had at present, or were likely to have for twenty years, might discover some mode of turning native flax to profitable account; but he would warn those who thought of emigrating to that colony not to turn their attention to flax manufacture, unless they were prepared to sink a great part of their capital—for this flax had occupied the attention of colonists for the last 20 years. During that time a vast amount of money had been spent upon it, without the slightest commercial success, and a colony was not a place for the scientific experiments of capitalists or amateurs. The first business of a colonist was to make sure of a livelihood by the staple pursuits of the colony, not to indulge in speculations, either in flax or copper mines, or veneered woods. With regard to copper ore, success depended upon the facilities for raising it. When South Australia was on the point of ruin, the Burra-burra mines were discovered, and saved the colony, but following that discovery there were no fewer than 97 other mines, of which not more than two had ever paid a shilling of dividend. The remarks he had made with regard to metallic ores applied with equal force to the woods of the colony. The wood was very pretty, and it might answer the purpose of a single cabinet maker in London to import a few logs or roots; but there was scarcely a quarter of the globe in which equally beautiful woods were not to be found; it was, however, found that it would not answer to bring them into competition with the rosewood and mahogany, which were obtained at so much less cost of labour and of freight. With regard to the awards of medals at exhibitions, he did not attach much importance to them; commercial demand was the best and surest reward for commercial producers. He advised those who thought of colonizing to turn their attention to pursuits which would put bread into their own and their children's

mouths. He did not, with Mr. Simmonds, anticipate any competition between the two colonies in the growing of wool, because the demand for that article was so great that manufacturers could consume the wool of a dozen purely pastoral colonies. But he would also warn intending emigrants against the idea that, whereas without cultivation they could feed three sheep per acre, with cultivation they could feed six sheep per acre. Those were statements, he apprehended, taken from New Zealand handbooks. The fact was that the land best adapted for sheep feeding was just that which was not fit for cultivation. Root cultivation on English principles was impossible with New Zealand prices of labour. The great profits derived from sheep feeding consisted in the fact that the animals were able to get their own living, with a comparatively small expense for shepherding. He agreed in the statement that those who emigrated to these colonies should go to settle if they meant to succeed, but he thought, too, that in the present day, the mass of the people understood emigration quite as well as those who intended to instruct them. As for the colonists, they might perhaps make mistakes in legislation, as we had done, but they were competent to work out a suitable government, and he doubted not that New Zealand would take up a creditable and successful position among the colonies founded by the English-speaking race.

Mr. E. WARD TRENT remarked that a misapprehension existed as to the mode in which the flax was prepared by the natives of New Zealand. The notion generally was that the leaves were scraped with a shell, but the fact was, incisions were made in the leaves, and the fibres were then stripped off, and formed the New Zealand flax of commerce. He felt persuaded that the method of cleaning the flax introduced by Thierry and others, would prove a failure, for this reason: that the persons employed in the work were not practical men; and they lost sight of one fact which the natives had discovered, viz., that one side of the leaf contained the silk-like fibre, whilst on the other side there was a ribby material; and under the process of Thierry these two materials became mixed together, producing a rough and unsaleable article. He thought any method which failed to separate the two classes of fibres, as was done in the native mode of preparing the flax, would be an utter failure. He had experimented upon most of the fibres that had been brought into the market during the last 25 years. The reason why New Zealand flax had been so little taken up was from the fact that it came over heckled, and the yellow bark, which had a deteriorating effect upon ropes made from it, was not got rid of. The quantity of material necessary for a three-inch rope with the yellow bark in it, would not be sufficient for a two-inch rope when that substance was not present. The specimens now exhibited confirmed the opinions he had previously expressed in the Society's *Journal*, that the methods of cleaning the flax recently introduced were complete failures, and it was a subject which still required investigation.

Mr. JOHN TOPHAM wished to inquire whether coal was worked in New Zealand to a sufficient extent to warrant a steam navigation company in depending upon it as a source of regular supply.

Mr. STONES said it was not so at present.

Mr. RIDGWAY remarked that that was because there was a want of labour to work the coals.

The CHAIRMAN, in proposing a vote of thanks to Mr. Stones, said the extraordinary interest and value of his paper merited their warmest acknowledgments. When they looked at New Zealand and reflected what it was 20 years ago, and saw the immense progress that the colony had made in that time, and the development of its resources under the enterprise and skill of its Anglo-Saxon settlers, they must feel more than ordinary obligations to the gentleman who had brought this interesting subject before them. Twenty years ago there was a population of only 4,000 Europeans in New Zealand; it now numbered upwards of 40,000, who, being themselves Christians, might look for the conversion of the native population to Christianity, and the development of those industrial arts which invariably followed in the wake of European colonisation. The paper had been a most attractive one, from the variety of subjects it embraced, and he was sure they would heartily accord their thanks to Mr. Stones.

A vote of thanks was passed to Mr. Stones.

The Secretary announced, that on Wednesday evening next, March 3, a paper by Mr. A. G. Findlay, "On the Progress of the English Lighthouse System" would be read. On this evening Henry Cole, Esq., C.B., will preside.

The Secretary also announced that the drawings by W. Mulready, R.A., the result of the Mulready Exhibition of 1848, about to be presented to the trustees of the National Gallery, will be exhibited on Wednesday evening next, when the Chairman will, previous to the reading of the paper, call attention to, and make a few remarks upon, the circumstances attending the presentation.

NORTHERN ASSOCIATION OF MECHANICS' INSTITUTIONS.

The Northern Association of Literary, Mechanics', and Educational Institutions of Durham, Northumberland Cumberland, and Westmoreland, was established in 1848, the object being the publication of an annual report, affording facilities for obtaining lecturers of ability on moderate terms, the free use of 100 manuscript lectures, the annual meeting of delegates, held every year in a different locality, at which meetings valuable information is elicited, and mutual sympathy and encouragement given for further exertions, the procuring of parliamentary reports free to the societies, advice where it is desired, on every subject connected with Mechanics' Institutions, to revise rules, to examine and grant certificates and prizes to the members of the associated Institutions, the interchange of privileges between the members of different localities, so that the members of one being temporarily in the neighbourhood of any other, may enjoy for a limited period the privileges of admission to its library and reading-room, and to offer suggestions for the formation of new societies, and generally to co-operate for the mutual benefit and encouragement of all societies having for their objects the intellectual improvement of the community.

In 1849 the Itinerating Library was established by Mr. J. L. Thornton, the honorary secretary, which has been followed by other unions forming similar collections of books for the use of the Institutions in their unions. The following are the rules of the library :—

I. That the books are intended exclusively for the use of the members of the Societies forming the Union.

II. That twenty volumes shall form one set; and that no society shall have more than one set at once.

III. That two months shall be allowed for each set of books; and if not returned within the time specified, the society detaining them shall pay a fine of sixpence per day.

IV. That the carriage of the books shall be defrayed by the societies.

V. That the books shall be sent at the risk of the societies, who shall replace them if lost or damaged.

VI. That, in every case, proper directions shall be for-

warded to the secretary, as to the manner in which the books have to be sent to each society.

VII. If any book be written in, or otherwise damaged, the society in whose hands the book was at the time shall pay the value of it, or replace it.

VIII. That when books are returned, they are to be delivered, free of all charge, to the secretary.

IX. No society shall be allowed to have books until its subscription for the current year has been paid.

X. No books shall be re-entered to the same society until the expiration of two months.

The principal object of the library was to supply small localities with a new selection of books. Many villages are so circumstanced, that where young people have no means of obtaining mental improvement by reading, the public-house is the only alternative for social intercourse and relaxation. The Itinerating Library of the Association was instituted to supply this deficiency, and to transmit to small societies and places where no reading-room exists, a succession of books calculated to improve the minds and elevate the character of the people. Although there are 36 boxes of books constantly circulating, the want of more books prevents the Association from extending the application of this great moral power to the extent which is desirable, and the demand which is constantly made upon them. The Association is under great obligations to His Royal Highness the Prince Consort for a valuable present of above 200 volumes to this library.

The following are the general rules of the Association:—

1. That the society be called "The Northern Union of Literary and Mechanics' Institutions," and that all Institutions including, amongst their objects, the intellectual advancement of the people, shall be admissible to the Union.

2. That the mode of admission shall be by a majority of the votes of the council, provided the society seeking admission shall forward to the Secretary of the Union a written application, signed by its secretary.

3. That the management of the affairs of the Union shall be intrusted to a council, consisting of a President, Treasurer, and Secretary, and ten other members, who shall elect their own chairman. The council shall be empowered to fill up vacancies which may occur during the year, and, generally, to be the medium of communication in any plans of co-operation among the Institutions in the Union. That Newcastle be the seat of the council.

4. That the expenses of the council shall be confined to the cost of advertisements, postage, the annual meetings, printing, copying of lectures, stationery, books, prizes, &c., &c.; and that the subscription be as follows:—Institutions having less than 200 members, 2s. 6d., and those having 200 members and upwards, 5s. per annum, payable in advance, and due immediately after the annual meeting.

5. That it shall be one of the objects of the Union to promote the exchange and circulation of lectures among the associated Institutes. The Union shall direct its attention to the development of all measures calculated to promote the moral and intellectual advancement of the people.

6. That an annual meeting of one delegate from each Institute having less than 200 members, and two delegates from each of those having 200 or more, shall be held to receive the report of the Union for the preceding year, to appoint a new council, to fix the place of the next meeting, and to confer upon any suggestions or new plans relating to the management of Mechanics' Institutes. The time of meeting to be fixed by the council, and six weeks' previous notice of the same shall be given to each society.

7. That, fourteen days prior to the annual meeting, each Institute shall transmit to the council a condensed report of its proceedings for the year.

8. That no alteration in the laws of the Union shall be made except at the annual meeting; nor then, unless notice of the same in writing shall have been sent to the secretary of the council at least one month previous, and been by him notified, at least three weeks before the day of meeting, to every society in the Union.

9. That no Institution shall separate from the Union except at the annual meeting; nor then, unless it shall have given one month's previous notice.

10. That the council shall be required to call a special meeting of delegates, provided two-thirds of the Institutes in the Union require it. The council in such case shall forthwith give one month's notice of the day of meeting to all the Institutes in the Union.

11. That the council may elect as honorary associates persons eminent for their attainments in literature, science, or art; or who have borne a distinguished part in promoting the welfare of Mechanics' Institutions, and furthering the progress of education.

12. That any person subscribing to the Union as an honorary member shall have the privilege of nominating one or more Institutions (according to the amount annually subscribed), which shall participate in all the benefits of the Union; and, in cases where this is not done, the right of nomination is assumed by the council. The honorary members are entitled to hold office, and to attend and vote at the annual meetings.

The Prizes and Examinations for the present year are as follows:—

The Examiners will award three classes of certificates, viz., 1. Certificate of Excellence, 2. Certificate of Proficiency; 3. Certificate of Competency; and to the highest certificate the Council will award the diploma of an honorary member of the Association. The Council of Examiners may recommend some additional prize to those whose acquirements deserve further recognition. Several merchants and manufacturers have intimated that they will receive the certificates of the Association as satisfactory in the appointment of clerks, &c.

The Examination will be conducted by written papers and oral examinations.

Every candidate offering himself for examination will be required to be a member of one of the associated Institutions, and to give notice to the Secretary on or before the 1st of June, and to state the subjects on which he wishes to be examined, and the books which he has studied.

Examinations will be held in English literature, grammar, and composition; writing from dictation; geography; arithmetic—common, vulgar, and decimal fractions, reduction, proportion, practice, and interest; book-keeping by double and single entry; mathematics; mechanics; chemistry; physiology; natural history; botany; mechanical and free hand drawing; English history; Latin, French, and German.

Prizes for 1858.

The following regulations must be observed with reference to the prizes:—That the competitors must be members of one of the associated societies. That the essays, &c., must be sent to the secretary (post-paid), under cover, endorsed with an English motto, and accompanied with a note, endorsed with the same motto, containing the author's name. The notes of the successful candidates only to be opened, and their name disclosed, after the Examiners shall have determined what essays are the best. The length of the essays not to exceed sixteen pages of the printed matter contained in one of the *Quarterly Reviews*, and they must be written only on one side of the paper, and in a good hand. That no essay shall be received after the 1st of July, 1858. When the language of other authors is employed, it must be marked by an inverted comma.

1. A prize of five pounds will be given by George Ridley, Esq., M.P., for the best essay—"Whether has the *Printing Press*, or the *Steam-engine* as applied to *Loco*

motion by *Land* and *Water*, conferred the greatest benefit on mankind."

2. A premium in books, suitably inscribed and bound, given by a friend, for the best dissertation on "The Historical and Romantic Ballads of Northumberland."

3. A silver medal, by the Association, for the best essay on "What Effect have Works of Fiction produced upon the present Age, and to what Extent should they be admitted into Public Libraries."

In cases where there may be no competition for a prize, it shall be left to the option of the Examiners whether the prize shall be given.

The Council reserve to themselves the right to publish the whole, or any parts of the successful essays.

Mathematical Prizes.—Question I.

By S. Fenwick, Esq., F.R.A.S., &c.

A series of parabolas which have a common tangent, and also a common directrix, revolve about an axis perpendicular to the directrix; prove that their foci generate a surface of the second order.

Question II.

By W. Rutherford, Esq , LL.D., F.R.A.S.

A grooved rigid rod of small diameter is placed with one end on a horizontal, and the other on a vertical plane, along which the rod slides without friction; and a particle, whose weight is inconsiderable with respect to that of the rod, is placed in a given position in the groove. How must the rod be placed initially, so that when it is abandoned to the action of gravity, and the particle allowed to move freely down the groove, the particle may just leave the groove at the instant the rod falls into a horizontal position?

Question III.

By W. S. B. Woolhouse, Esq., F.R.A.S., &c.

Supposing a cube to be thrown into the air at random, and a shot fired through it, determine the value of the probability that the shot will pass through opposite faces of the cube.

For the best solution to each of the above questions medals will be awarded by the Association. The ingenuity and elegance, as well as the correctness of the solutions sent by the competitors, will come under the consideration of the Examiners in estimating the value of each contribution. The mathematical prizes are open to all residents in, and natives of, the four northern counties.

The solutions must be sent on or before the 1st of July, 1858.

The following gentleman are the Honorary Examiners:

Mr. George Bell, M.A., Newcastle.
Dr. Charlton, Lecturer on the Principles and Practice of Physic, &c., in the Newcastle College of Medicine.
Mr. James Clephan, Gateshead.
J. P. Dodd, LL D., North Shields.
Mr. T. Doubleday, Author of "The True Law of Population," "Mundane Moral Law," &c., &c.
Mr. D'Acosta, Professor of Languages, Royal Grammar School, Newcastle.
Dr. Embleton, F R.C.S., &c., Professor of Medicine in the University of Durham
Mr. Stephen Fenwick, F.R.A.S., Royal Military Academy, Woolwich.
Mr. Grant, Author of "Madonna Pia," &c.
Dr. Humble, Lecturer on Materia Medica and Therapeutics, Newcastle College of Medicine.
Mr. R. Malcolm, Trafalgar-st. Academy, Newcastle.
Mr. T. F. McNay, Lecturer on Surgical Anatomy to the Newcastle College of Medicine.
Dr. Richardson, M.A., Professor of Chemistry in the University of Durham.
Dr. Rutherford, F.R.A.S., Royal Military Academy, Woolwich.
Rev. J. Snape, Head Master of the Royal Grammar School, Newcastle.
Rev. W. Spencer, B.A., St. John's College, Cambridge.
Mr. H. Wilson, Romulus-terrace, Gateshead.
Mr. W. S. B. Woolhouse, F.R.A.S., London.

Home Correspondence.

THE PUDDLING OF IRON.

Sir,—In reply to Mr. Wentworth Scott's letter which appeared in last week's *Journal*, I beg to state that an answer will be found to that gentleman's inquiries in the *Philosophical Magazine* for September 1857, in which Mr. R. Johnson and myself have published the details of our experiments on the chemical changes which pig iron undergoes during its conversion into wrought iron.

I am, &c.,
F. CRACE CALVERT.

Manchester Royal Institution, Feb. 24, 1858.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst., 2. General Monthly Meeting.
Entomological, 8.
Med. and Chirurg., 8. Anniversary.
Tues. Royal Inst., 3. Prof. Huxley, "On Biology."
Civil Engineers, 8. Discussion, "On Submerging and Repairing Telegraphic Cables."
Pathological, 8.
Photographic, 8.
Wed. Society of Arts, 8. Mr. A. G. Findlay, "On the Progress of the English Lighthouse System."
Pharmaceutical, 8.
Thurs. Royal Inst., 3. Prof. Tyndall, "On Heat."
Zoological, 3.
Royal Society Club, 6.
Antiquaries, 8.
Chemical, 8. Messrs. Perkin and Duppa, "On the Action of Bromine on Acetic Acid."
Linnæan, 8. I. Dr. Lindley, "Contributions to Indian Orchidology." II. Mr. Bentham, "Synopsis of the *Lygnotideæ*." III. Mr. Currey, "On the Fructification of the compound *Sphæriæ*."
Philological, 8.
Royal, 8½.
Fri. Archæological Inst., 4
Royal Inst., 8½. Prof. C. Piazzi Smyth, "Account of the Astronomical Experiments on the Peak of Teneriffe in 1856, illustrated by Photographs."
Sat. Asiatic, 2.
Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 17th February, 1858.

60. Dead Letter Office—Return.
65. Patriotic Fund (Colonies)—Return.
70. East India (Additional Troops)—Return.
74. East India (Police)—Return.

Delivered on 18th February, 1858.

46. Statue Law Commission—Return.
67. Queen Anne's Bounty—Account.
73. East India (Governor General)—Return.
79. East India (Sir Peregrine Maitland)—Return.
80. Sardinian Loan—Account.
81. Greek Loan—Account.
82. Russian Dutch Loan—Account.
20. Bills—Medical Charities (Ireland) Act Amendment.
21. ———Joint Stock Banking Companies.

Delivered on 19th February, 1858.

49. Westminster New Palace—Return.
57. Savings' Banks (Number of Depositors, &c.)—Accounts.
57. (1). Savings Banks (sums paid in or withdrawn)—Correspondence.

Delivered on 20th and 22nd February, 1858.

44. Excisable Liquors, &c., (Scotland)—Return.
69. Poor Relief—Return.
77. Public Debt—Account.
71. East India (Missionaries, &c)—Return.
84. Mint—Account.

87. Committee of Selection—First Report.
47. Cambridge University—Copies of Statutes.
23. Bill—Prescription (Ireland).

Second Session, 1857.

296. East India (Cotton)—Return. Part 1. Bengal and North Western Provinces.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Feb.* 19, 1858.]

Dated 5th January, 1858.

17. John Platt, Oldham—Improvements in machinery or apparatus for spinning and doubling or twining cotton and other fibrous materials.

Dated 21st January, 1858.

108. John Joshua Robinson, Fratton, near Portsea—Improved apparatus for sorting and stamping letters, books, newspapers, and other articles.

Dated 29th January, 1858.

161. Edward Hammond, Nos. 90 and 91, Herbert-street, Hoxton—The manufacture of cap fronts, and applicable to the manufacture of ruches, ribbon trimmings, and other articles of millinery.

Dated 1st February, 1858.

177. Thomas Heppleston, Manchester—Certain improvements in machinery or apparatus for doubling, twisting, and reeling yarns or threads.
179. James Alexander Manning, Inner Temple—Improvements in the manufacture or production of manure.
181. James Childs, Belmont, Vauxhall—An improvement in the manufacture of the boxes or cases used for night lights.
183. Josiah Haste, New Dock Works, Leeds—Improved apparatus for preventing the explosion of steam boilers.
185. Richard Archibald Brooman, 166, Fleet-street—Improvements in sewing machines. (A communication.)

Dated 2nd February, 1858.

187. William Cartwright Holmes and William Hollinshead, Huddersfield—Improvements in the manufacture of gas, and in apparatus employed therein.
189. William Edward Newton, 66, Chancery-lane—An improved instrument for sharpening the blades of knives. (A communication.)
191. William Westley, Birmingham—Certain improvements in the construction of heels for boots and shoes.
192. John Gray, Bonally Tower, Colinton, near Edinburgh—Improvements in printing machinery.

Dated 3rd February, 1857.

193. Edmund Moss, Manchester—Improvements in weighing cranes.
194. John Morris, Red House, Great Bridge, Staffordshire—Improvement or improvements in boots and shoes.
195. Alfred Hollis and Stephen Lee, Darlington—Improvements in the construction of chaldron-wagon and other railway wheels.
196. Anthony Nicholas Armani, Haverstock-hill—Improvements in rail or tramways for streets and ordinary roads.
197. Ernest François Dillage, 14, Boulevart Poissonniere, Paris, France—Improvements in machinery or apparatus for raising, forcing, and exhausting fluids, air, and gases. (A communication.)
198. William Edward Newton, 66, Chancery-lane—Improved apparatus for raising and lowering the skirts of ladies' dresses. (A communication.)
199. Leon Salles de la Magdeleine, Paris, France—An improved manure.
201. William Longley, Erith, Kent—Improvements in apparatus for grinding and splitting grain.
202. William Clark, 53, Chancery-lane—Improved hydraulic apparatus for obtaining motive power. (A communication.)

Dated 4th February, 1858.

203. Joseph Harrison, Brailsford, Derbyshire—Improvements in apparatus for making cheese.
204. Robert Harland, Derby—Improvements in the break lever guard of railway trucks.
205. David Smithies, Manchester—Improvements in the manufacture of healds or harness for weaving.
206. Benjamin Beale, Greenwich—Improvements in apparatus for paying out and drawing in electric telegraph cables, applicable also to the raising and lowering of weights.
207. John Avery, 32, Essex-street, Strand—An improvement in mechanical movements for sewing and other machines. (A communication.)
208. David Williams, Tredegar, Monmouthshire—Improvements in the construction of ovens or furnaces for the manufacture of coke, and in the means of emptying or discharging the same.
209. George Bertram, Edinburgh, and William McNiven, Polton Mill, Lasswade—Improvements in the manufacture of paper.
210. Charles Knight, St. John's-wood—An improved railway guide.
211. Julius Goodman and Louis Goodman, Finsbury-street, Finsbury-square—An improved portable umbrella.
212. William Rhodes, Manchester, and Henry Napier, Brooklyn, New York—The production of a "new paint oil."

Dated 5th February, 1858.

213. Alexander Crichton and Matthew Whitehill, Paisley, Renfrew, N.B.—Improvements in the application, adaptation, and use of knitted fabrics.
214. Edward Collingwood and Thomas Collingwood, Rochdale—Certain improvements in machinery or apparatus for propelling vessels on water.
215. Adam Woodward, and William Carter Stafford Percy, Manchester—Improvements applicable to hoists and other apparatus or machinery for raising and lowering weights, designed as a provision against accidents, to which such apparatus or machinery is liable.
216. James Welch, Southall—Improvements in railway and other carriage brakes.
217. Sir Charles Shaw, Chapel-place, Cavendish-square—Improvements in constructing moveable or field batteries.
218. Samuel Williamson, Hanover-street, Cork—Improvements in the construction and mode of affixing street and other gas lamps or lanterns.
219. Samuel Dyer, Bristol—Improvements in the method of reefing, furling, and securing all the sails of ships or vessels.

Dated 6th February, 1858.

222. William Potts, Handsworth, Staffordshire—Improvements in painting upon glass, and in protecting paintings upon glass.
224. William White and Joseph Parlby, Great Marylebone-street—Improvements in the preparation or treatment of carton-pierre, papier maché, and such like plastic substances, and in the application of such matters to walls, ceilings, and other internal parts of buildings, berths, and other parts of ships and other vessels, carriages, and other structures.
225. William Ball, Rothwell, near Kettering, Northamptonshire—Improvements in the construction of ploughs.
226. John Miller, Upper George-street, Edgware-road—Improvements in machinery for the manufacture of bread. (A communication.)

Dated 8th February, 1858.

227. Robert Wilson, Liverpool—Improvements in propelling navigable vessels.
228. François Mathieu, Lawrence-lane—Improvements in stereoscopes.
229. Julius Decimus Tripe, Commercial-road—Improvements in apparatus for securing window sashes or casements. (Partly a communication.)
230. Pierre Simon Meroux, St. Denis, France—Improvements in fire bars and grates for furnaces or other fire places.
231. Robert Cunningham, Paisley, Renfrew, N.B.—Improvements in or connected with the production of letter-press printing surfaces and surfaces used in reproducing ornamental patterns or devices by printing or otherwise.
232. Edward Dench, Chelsea—An improved boiler for heating water for heating and warming.
233. Richard William Johnson and William Stableford, Oldbury, Worcestershire—Improvements connected with the break levers of railway wagons.
234. William Edward Newton, 66, Chancery-lane—Improved machinery or apparatus for breaking stones, minerals, and other analogous substances. (A communication.)
235. Henry Ball, Birmingham—Improvements in repeating and other fire-arms, a portion of which improvements may be applied to ordnance.
236. Edward Reader and John Dewick, Finkhill-street, Nottingham—Improvements in lace machinery for the manufacture of velvet lace and looped fabrics, and in the fabrics manufactured by such machinery.

Dated 9th February, 1858.

237. Charles Askew, 27½, Charles-street, Hampstead-road, and David Ritchie, 42, William-street, Regent's park—Improvements in roasting machine for meat, poultry, or game of any kind, to be worked by spring jack movements, or by the ordinary smoke jack.
238. John Wells, Percival street, Clerkenwell—Improvements in watch cases.
239. William Brown and Charles Neale Day, Devizes—Improvements in sluice valves.
242. Evan Leigh, Manchester—Certain improvements in carding engines for carding cotton and other fibrous materials.
243. John Taylor, Swanton Novers, Thetford—An improvement in the construction of horse hoes, applicable also to drills.

WEEKLY LIST OF PATENTS SEALED.

February 19th.

3010. Julien d'Helle and Albert Viscount de Waresquiel

February 23rd.

2236. George Daniel Davis
2243. John Gedge
2248. Henry Parry
2251. John Jervis Tucker and George Blaxland
2252. Werner Staufen
2255. Philip Hill and John Moore
2256. John Gedge
2258. William Hargreaves
2268. Charles Thompson and James Thompson
2274. John Drumgoole Brady
2382. William Jenkins
2384. David Thorpe Lee
2404. Richard Brown
2406. Peter Armand le Comte de Fontainemoreau

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

February 15th.

361. John Oxley
374. Frederick Blacket Edward Beaumont

February 19th.

389. Paul Prince
390. Charles Low
398. William Hartcliffe and Joseph Waterhouse
409. Barnaby Angelo Murray
453. Thomas Sadleir

February 20th.

367. David Hulett
386. Frederic Prince

Journal of the Society of Arts.

FRIDAY, MARCH 5, 1858.

COUNCIL.

The Council will be specially summoned, for Wednesday next, the 10th instant, at 6 o'clock, to consider—

1. Whether this Society should at once announce its intention to direct and superintend an Exhibition, in 1861, or any other year.
2. What should be the exact character of such an Exhibition.
3. Whether the surplus funds, if any, should be appropriated by the Society to the advancement of Arts, Manufactures, and Commerce.

EXAMINATIONS, 1858.

In accordance with the new Bye-laws, the Council have had under consideration the appointment of the Board of Examiners. Having to nominate only one Examiner for each of the subjects included in the "Programme" for 1858, the Council have found themselves charged with the delicate and difficult duty of selecting less than a moiety of the names of those gentlemen who in the autumn of last year had liberally consented to serve gratuitously as Examiners this year.

The Council could not but feel that the Society was under much obligation to those gentlemen, many of whom had already given their valuable services gratuitously in former years; and it was a difficult but necessary duty to make the requisite selection.

The Council have now the pleasure to announce that the following gentlemen have been appointed the Board of Examiners for 1858 :—

Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
Mathematics.	
Algebra	Rev. Harvey Goodwin, M.A., Cambridge.
Geometry Mensuration	Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.
Trigonometry Conic Sections	William Spottiswoode, Esq., F.R.S.
Physics.	
Navigation and Nautical Astronomy	John Riddle, Esq., M.A., Head Master of the Nautical Schools, Greenwich.
Statics, Dynamics, Hydrostatics Practical Mechanics	Rev. A. Bath Power, M.A., Principal of the Diocesan Training School, Norwich.
Magnetism, Electricity, and Heat	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
Astronomy	Rev. Baden Powell, M.A., Savilian Professor of Mathematics in the University of Oxford.
Chemistry	Dr. A. W. Williamson, Professor of Chemistry, University College, London.
Animal Physiology	William Sharpey, Esq., M.D., F.R.S., Examiner in University College, London.
Botany	Arthur Henfrey, Esq., F.R.S., Professor of Botany, King's College, London.
Agriculture	
Political and Social Economy	
Descriptive Geography	William Hughes, Esq.
Physical Geography	Rev. Samuel Clark, M.A., Principal of the Training College, Battersea.
English History	E. S. Creasy, Esq., Professor of History, University College, London.
English Literature	Rev. F. Temple, M.A., Head Master of Rugby School.
Latin and Roman History	F. R. Sandford, Esq., B.A., Assistant Secretary to the Committee of Council on Education.
French	A. Mariette, Esq., Professor of French, King's College, London.
German	Dr. Bernays, Professor of German, King's College, London.
Freehand Drawing	F. S. Cary, Esq.
Mechanical Drawing	Thomas Bradley, Esq., M.A., Professor of Geometrical Drawing, King's College, London.

FINANCIAL PRIZE ESSAY.

The following gentlemen have, at the request of the Council, undertaken the duty of adjudicating upon the merits of the Essays sent in for competition :—

John Towne Danson, Esq., Fellow of the Statistical Society.
C. Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
Jacob Waley, Esq., M.A., Professor of Political Economy, University College, London.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of *recent* Inventions.

Persons intending to contribute to the Exhi-

bition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.

2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid.*

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

No charge whatever is made for space, and the Exhibition is free.

ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relative to this subject, has been prepared at the request of the Committee, by D. Roberton Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,
Smallness of size,
The avoidance (if possible) of fluid ink,
Durability,
Cheapness, with a guaranteed supply, and
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, Auditor	10	10
T. H. Bastard	5	0
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
Henry Cole, C.B., Vice-Pres.	1	0
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

THE PATENT OFFICE.

The following Memorial is about to be presented to the Commissioners of Patents, and will lie at the Society's house for a few days, for receiving the signatures of members :—

To the Right Honourable Frederick, Lord Chelmsford, Lord High Chancellor of Great Britain; the Right Honourable Sir John Romilly, Master of the Rolls; Sir Fitzroy Kelly, Her Majesty's Attorney-General; and Sir Hugh McCalmont Cairns, Her Majesty's Solicitor-General.

The Memorial of the undersigned Members of the Council and Members of the Society for the Encouragement of Arts, Manufactures, and Commerce,

Humbly Sheweth,—That it appears to your Memorialists that a largely increased accommodation is urgently required for the numerous inventors, engineers, and others, who daily consult the official documents and valuable Free Library of the Great Seal Patent Office, and who desire to inspect the instructive models collected by the Superintendent of Specifications, to which additions have been continually offered from all parts of the United Kingdom.

That although recent alterations in the Laws affecting Patents have stimulated inquiries in every branch of knowledge connected with Industrial Arts, and the publications of the Commissioners have largely facilitated such investigations, yet the full benefit of these excellent measures cannot be realised so long as only the present small apartments are devoted to this national undertaking.

That the present Library is the only one in the United Kingdom in which the public have free access, not only to the Records of the Patents and Inventions of this Country, but also to the Official and other Documents relating to Inventions, contributed by numerous Foreign Governments, who have liberally responded to the desire of the Commissioners to promote international relations for the improvement of Manufactures, by the encouragement of Invention.

That it cannot but be a matter of regret that, while a surplus, already large, is continually accruing from the fees paid for Patents in this country, the buildings devoted to the purposes of the Patent Office are insufficient in themselves, and contrast most unfavourably with those of Foreign States.

Your Memorialists, therefore, pray that you will be pleased to take such steps as may seem to you advisable for the erection and maintenance of a commodious Patent Office worthy of this country, and where ready access may be had to a Library, Reading-room, and Museum, furnished with the papers, books, and models indispensable to the right direction and advance of British Industry.

THIRTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 3, 1858.

The Thirteenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 3rd inst., Henry Cole, Esq., C.B., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Ashworth, Henry	Jones, Thomas Mayhew
Behnes, William	West, Walter
Hewett, John	Westmacott, Richard, R.A.

The Drawings by W. Mulready, R.A., the result of the Mulready Exhibition of 1848, were exhibited, and the Chairman made the following observations in reference to them:—

The idea of establishing a National Gallery of British Art, was first specially fostered by the Society of Arts. In the year 1847, the public possessed only those few pictures of the British School which had been purchased with Mr. Angerstein's collection of pictures. British pictures, indeed, at that time, in the judgment of the great connoiseurs, ranked very much below second or third rate Italian pictures. At a meeting held in February, 1847, a proposal was made to this Society, which always has the courage to be in advance of public opinion, to assist in forming a National Gallery of British Art, and the paper embodying the idea was read and discussed, and may be found printed in the volume of Transactions for the year.

It was suggested that an annual Exhibition should take place of the works of some eminent living artist, and that any profits which might result from this exhibition, together with any special donations, should be applied in purchasing some work or works of the artist whose productions were exhibited, and that these works should be presented to the National Gallery as a means of founding a Gallery of British Art, and thus vindicating the rights of National Art to be duly recognised in a National Collection.

An exhibition accordingly took place of the works of William Mulready, in the year 1848, and a small surplus of £240 was obtained, which, having been paid to Mr. Mulready, he, in return, has presented to the Society three of his remarkable drawings, two in chalks and one in pen and ink, which the Council have accepted, and have offered them to the trustees of the National Gallery in accordance with the original proposal. Previous to accepting the drawings offered by Mr. Mulready, the Council referred the matter to a Committee to report to them on accepting the works submitted. That Committee consisted of the following gentlemen:—Sir Charles Eastlake, P.R.A., Mr. John Bell, Mr. F. S. Cary, Mr. J. C. Horsley, A.R.A., Mr. R. Redgrave, R.A., Mr. D. Maclise, R.A., Mr. S. Haden, Mr. W. Hawes, Mr. S. Hart, R.A., Mr. S. Hickson, Mr. David Roberts, R.A., Sir J. P. Boileau, Bart., Mr. J. Thompson, Mr. C. Wentworth Dilke, Mr. H. Cole. That Committee reported as follows:

"The Committee have carefully examined the drawings liberally offered by Mr. Mulready, and are unanimously of opinion that as studies which have been rarely equalled in ancient or modern times, they are well worthy of the acceptance of the Council, with the view of offering them to the trustees of the National Gallery.

"Considering the number of pictures by Mr. Mulready, which the nation now possesses, the Committee are of opinion that he has shown sound judgment in offering drawings which exhibit the successful use of chalks as well as what may be done by the pen in the hands of an accomplished artist."

Mr. Etty's pictures formed the second exhibition, which hardly paid its expenses, and the further prosecution of the idea was dropped, because a National Gallery of British Art was being formed by other means.

In 1847, a few months after the idea thus nurtured by the Society had been suggested, Mr. Vernon gave his pictures to the nation.

Some time before Mr. Vernon's gift was made, Mr. Sheepshanks had stated generally to his friends that he proposed to give his pictures to the country, and Mr. Sheepshanks consulted Mr. Vernon on the expediency of making a joint gift of their separate collections of pictures, coupling with it the condition that the government should first provide a suitable building to receive them. Unfortunately for the exhibition of the pictures, Mr. Vernon preferred to stand alone, and declined to co-operate with Mr. Sheepshanks, and his pictures, having first been concealed in the basement of the National Gallery, have been for years only a little less invisible on the ground-floor of Marlborough-house.

Owing to his foresight, Mr. Sheepshank's pictures have been well-housed and are seen, even far away in the wilds of Kensington, by greater numbers in a corresponding period than visit Mr. Vernon's dimly-lighted pictures at Marlborough-house. Turner, too, has given his magnificent collection to the country. The effects of the Lawrence

bequest will also tell in forming a British Gallery, and the idea of a British Gallery of Art, which the Society thought it right to cherish in 1847, seems likely to grow to such dimensions as to require some new mode of treating it.

As the treasures of Art accumulate, common sense suggests that they should not be allowed to form an overgrown wearisome centralized collection, located only in one spot of the metropolis, but that the finest specimens should be chosen for the central gallery, and that the whole country should enjoy the means of borrowing the surplus. Encourage the provision of suitable buildings for exhibiting pictures and works or Art, not merely in the metropolis, with its three millions of people, spreading over a diameter of twelve miles, but over the whole kingdom, and circulate the superfluous pictures from local gallery to local gallery. The State, with local co-operation, would then do with National pictures that which the wealthy have been accustomed to do with their own pictures with safety at the British Institution for more than half a century.

If the Vernon, Turner, and Sheepshanks pictures were all collected together, a noble gallery of British Art would be formed, and at least half the whole number of pictures would be available for circulation over the whole kingdom. Mr. Sheepshanks' gift provides for such a distribution. The Treasury and trustees of the National Gallery have full powers over the Turner bequest, but an Act of Parliament would be necessary to render the superfluous Vernon pictures generally useful. This principle of distribution is already in full operation with works of Ornamental Art belonging to the Kensington Museum. Every local School of Art is privileged to borrow whatever is portable, and experience has shown that even Venetian glass and precious Majolica may be safely circulated. A thousand pieces were sent to the Manchester Art Treasures Exhibition, and not a single accident took place. The distribution of pictures would be all the easier, and might be managed with the least possible risk.

Should this suggestion of circulating works of art be acceptable to the public, it may be hoped that these Mulready drawings may assist in giving some practical direction to it.

The Paper read was :—

ON THE PROGRESS OF THE ENGLISH LIGHTHOUSE SYSTEM.

By A. G. Findlay.

It is now ten years since I had great pleasure in drawing the attention of the Society of Arts to the Lighthouse system of our country, a system which, viewed in relation either to its utility, or to the beauty and excellence of its details, is worthy of the highest admiration of a nation which boasts of its maritime superiority. Yet, at the period I allude to, the beautiful appliances of science, the results of profound investigation therein, were but imperfectly understood or appreciated by those unconnected with it, and there was no work which embodied the description and pointed out the utility of our lighthouses.

In the paper above referred to, which is printed in the Society's Transactions for 1847-8, and in the excellent account of the Skerryvore Lighthouse, by Alan Stevenson, Esq., which appeared soon afterwards, the main features of the system, as then existing, are detailed.

The period which has since elapsed has not been unimportant, either in the improvements of lighthouses, or, in what is of more consequence, their requirements. It is proposed to treat of both these topics in the present paper. But before entering into the details of either of these two branches of our subject, some brief recapitulation of my previous account may be necessary, in order to put the present meeting in possession of the main facts concerning pharology. Thus this, like my former paper, will bear somewhat of an historical character, which it is thought will be best to develop the plan of the existing position and requirements of a lighthouse.

First as to the illumination. There are two systems now employed; the older one of lamps with metallic reflectors placed behind the light, the catoptric, or as it may be called the English system, and the other where the light is controlled by lenses placed before it, or the dioptric, known as the Fresnel or lenticular system, which was first brought into general use in France.

The merit of priority in the former undoubtedly belongs to England. Polished metallic reflectors were invented in England, and first used at the Liverpool lighthouses. Of late the credit of the invention has been given to Chevalier Borda, who, with the assistance of M. Lenoir, constructed some reflectors of silvered copper for the famous Cordouan lighthouse, off the mouth of the Gironde, in the year 1780.

M. de Teulère, a member of the Royal Corps of Engineers of Bridges and Roads in France, has also been considered by some as the first to have directed attention to the utility of paraboloidal reflectors, and is said to have proposed a revolving reflector light for the Cordouan, in 1783. But in re-affirming the statement made on pages 287 and 288 of the Proceedings of the Society, before referred to, that William Hutchinson, mariner and dockmaster of Liverpool, invented and used metallic reflectors at that port prior to 1777, and most probably in 1763, an anecdote which I have met with adds to the certainty of the early date of the invention.

It is stated that William Hutchinson, in the year 1763, laid a wager, which he won, that he would read from a book, at the distance of 200 feet, by the light of a farthing candle. He did this with the aid of one of the Liverpool Lighthouse reflectors.

The reflectors used in the Liverpool lighthouses at the period alluded to, were formed on a parabolic curve of 1, 2, and 3 feet focus, and 3, 5½, 7½, and 12 feet in diameter, the smaller ones of tin plates soldered together, and the larger of wood, covered with looking-glass. The lamps consisted of flat wicks of from 3 to 14 inches broad, the supply of oil being kept uniform by a dripping-pot behind the reflector, as shown in the diagram. These and more perfect reflectors are described in Hutchinson's excellent work entitled " A Treatise on Practical Seamanship," and published in 1777. Mr. A. Stevenson, quoting a second edition of the same work, published in 1791, under a different title, running thus: " A Treatise, &c., on the best form of Merchant Ships, &c.," has been led to give the priority to the French.

The next advance in the economising of light was that made by Mr. Thomas Smith, the engineer to the Scottish Lighthouse Board, who, in 1786, introduced the reflector which I have the pleasure to exhibit. It is formed of a hollow paraboloidal mould of plaster, lined with facets of mirror glass. Mr. Smith originated this idea himself, without being aware of what had been done at Liverpool and in France previously. These contrivances were in use prior to Argand's invention of the tubular wicked lamp, which was a great step in the art of illumination. The first polished metal reflectors used in Great Britain, were placed in the Inch Keith lighthouse in 1803.

As far as the principle is concerned, the catoptric system was perfect when Captain Huddart determined the best form for the parabolic curve of these reflectors, and his principle is still in use. To clearly understand the action of these reflectors, a reference to the diagram will be sufficient; it will be seen that the form of the curve is such that, a line or ray from the focus striking any point of the inner face of the parabola, will do so at the same angle as that of a horizontal ray reflected from that point; therefore all rays of light, so reflected, will pass off in a horizontal direction; and, supposing that the light was a single point,

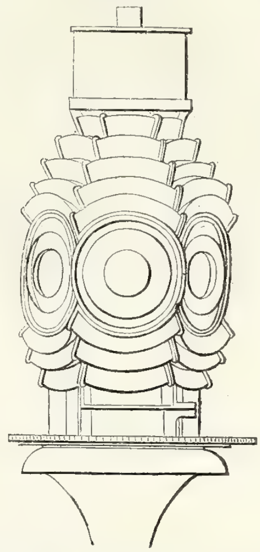
the reflector would send forth a cylinder of rays equal in diameter to its double ordinate, or the diameter of its mouth, consequently it would be impossible to show a light all round the horizon with any number of such instruments; but, as the flame of the lamp is about one inch in diameter, this subtends an angle of 14 deg. 22 min., at the vertex of the parabola, of 4 inches focus, (the usual size of lighthouse reflectors); this, with other circumstances, makes it necessary to use from 25 to 33 such reflectors to form a complete zone of light.*

The catoptric system is still in use in the majority of our lighthouses, as it possesses some advantages over the dioptric system, as will be seen presently.

The dioptric or lenticular system, like that of the reflectors, has arisen, step by step, to its present condition. The great size which a lens must be to control any great volume of light, would require such a mass of material that many conditions render the ordinary convex lens inapplicable to the purpose. The general plan of the lens as now used, was suggested as a good form of burning glass by Buffon, in 1773. For lighthouse purposes the form now applied was first proposed in Britain, by Sir David Brewster, in 1811, who showed that a lens might be built up of separate pieces to any size. Previous to this, in 1780, the Abbé Rochon ground down a light piece of glass to concentric rings, and a similar lens was made by Messrs. Cookson, of Newcastle-upon-Tyne, for the Northern Lighthouse Board. The great trouble and difficulty attending the construction of such lenses precluded their general use.

In the year 1819, M. Augustin Fresnel, without knowing what Sir David Brewster had done in England, proposed a polyzonal lens of the same character, and afterwards, in conjunction with MM. Arago and Mathieu, applied the system to the Cordouan lighthouse. The new apparatus was first shown on July 23, 1823. M. Augustin Fresnel subsequently made the system much more perfect, and hence it is generally called by his name.

The lenticular apparatus is placed around the single central lamp, as shown in the example I am enabled to exhibit. The arrangement of glass is so constructed as to refract the rays emitted from the lamp in the focus of the apparatus in every direction, into beams parallel with the horizon.

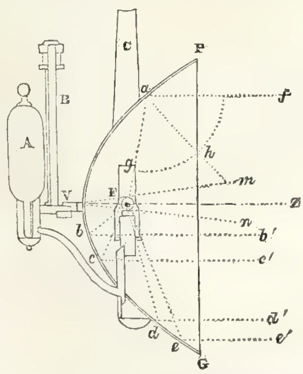


This apparatus is a holophotal fourth-order lens, showing a revolving light. The oil reservoir is placed over the apparatus, which consists of six polyzonal lenses around the flame of the lamp, above each of which are six portions of catadioptric rings, which are made concentric with the central portion, below which are three central rings. On the revolution of this machine each face sends forth a flash of nearly the whole light emitted by the lamp. I am indebted to Messrs. Wilkins and Co. for the opportunity of showing this apparatus.

It will be readily understood, that for an instrument of this character to perform its office, many conditions are necessary, first the glass, which is used in such large masses must possess perfect homogeneity, it must possess great transparency, and its figure must be formed with great accuracy to ensure successful operation. Its action may be briefly explained as follows, assisted by the illustrative diagram. A plano-convex lens of 30 inches diameter, as required in a first-order apparatus, would, if not formed on the polyzonal principle, be above 11 inches in thickness in the middle, a condition manifestly impracticable. The convex surface of the lens is, therefore, supposed to be cut into circular zones of triangular section, so that all the solid portion of the lens is dispensed with; these sectional zones are then arranged on one plane, and have the same refractive properties as if they were one solid piece, because the two surfaces are of the same relative figure.

For a revolving light, the lenses of the central portion of the apparatus are arranged into an octangular prism which in the largest or first-order light is 6 feet $\frac{1}{20}$ inch in diameter. For a fixed light the central part of the apparatus is formed of a band of lenses whose section is determined by the horizontal revolution of the figure of the polyzonal lens. This portion of a first-order light economises rather more than one-fourth of the whole light emitted by the lamp in its focus, or 92 deg. At first it was thought impossible to construct this central drum or belt of a circular form, and it was then made a polygon of thirty-two sides, but Messrs. Cookson, in 1836, constructed a circular one, which greatly increased the power and utility of the apparatus.

* P V G is a vertical section of a reflector; F the focus and



situation of the flame of the lamp; A the oil fountain; C the ventilating tube. The angle of incidence being equal to the angle of reflection, the angle V a g at which the ray F g a falls on the surface of the parabola at the point a is equal to the angle P a f, at which it is reflected from the surface; therefore, the angle made by the ray falling on, and being reflected from, the surface, will be bisected or divided into two equal parts by the perpendicular to the tangent of the parabola at the point of incidence, therefore the angle g a f is bisected by g h m, that is, the angle g a h is equal to the angle h a f. The peculiar property of the parabolic curve is that the ray, when reflected from any point, is always thrown in a direction parallel to the axis of the curve; that is, the direction a f of the reflected ray is parallel to the axis F Z. Thus a copper reflector, lined with highly polished silver, formed to such a curve, with a mathematical point of light placed in its focus, as F, will reflect the rays from it in straight lines, parallel with its axis V Z, as F b b', F c c', F e e', &c., and thus send forth a cylinder of light, whose diameter is equal to the double ordinate of the reflector, P G.

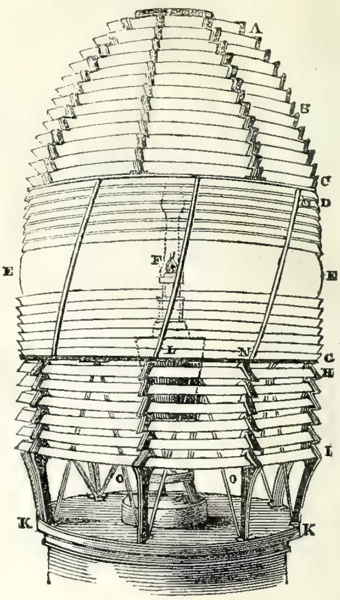
To control that portion of the emitted light which passes upwards over this central belt, and amounts to three-eighths of the whole quantity, the plan first adopted by Fresnel, was to place a series of small mirrors disposed in seven tiers gradually decreasing in diameter, forming a species of cupola above the central belt. These mirrors, strictly speaking, would be portions of such parabolas as would, if carried around the focus, form perfect reflectors, as may be comprehended from the diagram. In practice, however, owing to the breadth of the flame, they were formed of silvered plate glass, inserted into small brass frames, and suspended by screws at the back to an iron frame work. In revolving as well as fixed lights, this portion of the apparatus is fixed, and gives the continuous light visible between the flashes of a revolving light, which flashes are produced by making the eight polyzonal lenses revolve in a regular interval, and by this means the rays from the lamp being directed in eight directions, cause a bright flash to appear to the distant observer at intervals of one-eighth of the period occupied by the revolution of the entire apparatus.

The portion of light which escapes below this central belt was also economised by the same means; that is, four tiers of these mirrors were placed below, of equal diameter with the whole apparatus, and were constructed on the same principle. These arrangements affect about four-fifths of the entire amount of light, but in doing this there is the great loss caused by the absorption of light by metallic specula, which perhaps amounts to one-half of the whole incident light.

This last consideration led M. Fresnel to construct his small dioptric apparatus, with refracting and totally reflecting glass zones above and below the principal portion. The action of these zones may be familiarised by the use of the ordinary prism, which refracts the incident ray in one direction, and if it receives it on the inner surface of the opposite side at a greater angle than about 41 deg. 49 min., the ray is totally reflected, and ultimately emerges from the prism in a horizontal direction, the only loss of light being caused by the absorption by the glass. The first application of this principle on a large scale is due to the suggestions and calculations of Mr. Alan Stevenson, and it was first introduced in the noble Skerryvore light, which was completed on December 23, 1843, by M. François Soleil. "Nothing can be more beautiful," says Mr. Alan Stevenson, "than an entire apparatus for a fixed light of the first order. It consists of a central belt of refractors, forming a hollow cylinder, 6 feet in diameter and 30 inches high; below it are six triangular rings of glass ranged in a cylindrical form, and above a crown of thirteen rings of glass, forming by their union a hollow cage composed of polished glass, 10 feet high and 6 feet in diameter. I know of no work of art more beautiful or creditable to the boldness, ardour, intelligence, and zeal of the artist."

Such is the general arrangement and operation of the apparatus for a large lighthouse showing a fixed light. For a revolving light, such as the Skerryvore and the Cordouan, a different arrangement is adopted, which, as it is only a modification of those above described, and as most persons are familiar with the fine examples of this apparatus exhibited in our own Exhibition of 1851, and in the later French Exposition, it need not be dwelt on now.

There is an arrangement of the lenticular apparatus which, at the period of my former paper, was not in use in our English system, although generally adopted in France and elsewhere. It is for the purpose of showing a fixed light, varied by a flash, preceded and followed by short eclipses (*feu fixe varié par des éclats*). It consists of a supplementary system to the ordinary lenses for a fixed light, which as I have been describing, distributes its light evenly all around the horizon in a belt equal to the height of the apparatus, increased by its slight powers of vertical divergence. Around this apparatus, consisting of horizontal cylindrical elements, two or four panels of lenses, composed of vertical cylindrical elements, or at right angles to the main apparatus, are made to revolve. The effect of this additional arrangement is to cause those horizontally divergent beams which fall on the inner surface, to become parallelised, and thus reach the observer in the form of a flash, which is preceded and followed by a short eclipse, due to the angle between the parallelised and divergent beams. This, though a beautiful arrangement, has some drawbacks in the absorption of the light through the double apparatus. The effect, moreover, is open to some objection, which will be touched on presently. This form of lenticular apparatus has been largely used of late in the new lighthouses constructed by the United States for their coasts.



View of a first order *fixed* dioptric light.—F, the focus, or flame; L, the lamp; D, E, E, G, the central belt of refractors; M, N, diagonal brass frames to panels of central refractors; H, I, six lower catadroptric zones; A, B, C, thirteen upper catadroptric zones; O, O, diagonal legs; K, K, service table.

Of the seventeen dioptric apparatuses which were employed in British lighthouses ten years since, nearly all the glass portions were of French construction. Our shores had at that time been furnished with almost a complete system of lighting and beaconage, and the apparatus of the catoptric class was of the most refined and beautiful description, perfectly fulfilling its office as far as its capabilities would allow it.

The conditions of pharology in France were different. Soon after the establishment of the lenticular system, in 1822, by Augustin Fresnel—that is, in 1825—the Lighthouse Commission decided on the exclusive use of that system of illumination for their coasts and those of their colonies; the distribution of the lights being that recommended in the programme and report of Rear-Admiral de Rossel. The Central Commission at Paris established a workshop and depôt for the construction of the apparatus, and, in the twenty subsequent years, they supplied not only nearly the whole of the first-order apparatus for their own coasts, but also a large number for the neighbouring governments. During this period, the fiscal regulations embarrassing the glass manufacture precluded English enterprise from dealing with the large masses of metal required for the construction of these lenses. Besides this, the material procur-

able near Paris is so superior to any of a similar kind that is attainable from our own country, that it is another reason why our French neighbours took the precedence of us in this branch of scientific art; and thus a large proportion of the principal light apparatus, on a large scale, necessary for the safety of the mariner, had been erected before the removal of the excise duty on glass.

Without pursuing this part of the subject into its details, it will suffice here to state that the foregoing embraces the general principles of lighthouse apparatus as in use in 1847. The minor features, in their great variety, may be followed in the excellent works of Mr. Alan Stevenson and M. Fresnel.

In instituting a comparison of the efficiency and economy of the two systems,—a question which has been strongly discussed,—many points have to be considered. It has been usual with many to give the superiority, on both heads, to the dioptric system; but there are numerous conditions under which it can be demonstrated that the authorities of our Trinity Board have acted quite wisely in retaining the reflector system, under which so many of our fine lighthouses have been established. A few words on the peculiar properties of each will be sufficient now. The discussions, involving a large mass of calculations, are extant elsewhere.

The effect of a paraboloidal reflector of 21 inches diameter and 4 inches focus, when viewed directly in front of the flame of the lamp, one inch in diameter, is equal to 270 flames; at a divergence of 7 degrees from the axis, about 44 flames; and between 9 and 10 degrees of divergence from the axis it is 2 flames. The diagram above will illustrate this distribution of the light. The available or useful amount of divergence altogether is about 15 or 17 degrees, the actual amount from such a flame is 14 deg. 22 min. Vertically, the divergence is about 16 deg. 8 min., or it will be serviceable to 20 deg. This is a useful property, as will be seen presently. It will, therefore, take from 25 to 33 such reflectors to form a complete circle of useful light. But this cannot be evenly distributed over the whole azimuth. The spaces between the axes of each reflector will be illuminated with a fainter beam. This inequality in the distribution of the light is the great disadvantage of the catoptric principle for a fixed light. For a revolving light, when eight reflectors are placed on each side of a revolving triangular frame, a flash may be attained quite as bright as that from the great annular lens of Fresnel. The duration of this flash is also three times the duration of that from the lens—a great advantage, but then the eclipses between the flashes are total, in which the Fresnel system has the superiority.

The dioptric system owes its great superiority, for a fixed light, to its perfectly fulfilling the very important condition of distributing the light evenly all round the horizon. For a revolving light the eight lenses will give flashes of equal intensity, but of much shorter duration, than the 24 reflectors of the catoptric light. The secondary light from the fixed upper and lower zones compensates for this inferiority. The lamp of the dioptric apparatus consumes the same quantity of oil as 15 of the reflector lamps, and is therefore more economical, in the ratio of 5 to 8, supposing the serviceable effect of these lights to be equal, but this does not quite fairly state the case. Fresnel calculates that in a first order apparatus for a fixed light, the brilliancy of the dioptric drum, or central portion of the apparatus, will be equal to 360 flames, that of the cupola of catadioptric zones above to 140 flames, and the lower zones to 60 flames, a total of 560 burners in all directions. Mr. Stevenson, who is probably nearer the mark, says 450 burners for the joint effect of the dioptric and catadioptric parts of the apparatus for a fixed light, and, calculating the whole effect of this apparatus as compared with the reflector light, that with the same quantity of oil, about four times the quantity of light is produced by the lenses as by the reflectors; but then the light, as seen before the axis of each reflector, would be 50 per cent. more powerful than the dioptric light. In revolving lights, assuming the same calculations, the dioptric light is more advantageous than the reflector, in the proportion of 3·6 to 1. This is supposing that the light is required round the whole horizon, but in numerous cases only a portion of the circumference is required to be illuminated, and this circumstance still reduces the average superiority of the dioptric system, so that, all things considered, the relative advantage of each system may be from one and a half to twice in favour of the dioptric.

There is one appearance which is produced by the lenticular apparatus which could not be made by reflectors, and when the distinction between one light and another is of such paramount importance, this is no small object, I allude to the fixed light varied by flashes. Perhaps this variety may be overrated in its utility. Mr. Alan Stevenson does not think it of so much value in its distinctive characteristic, and, up to a recent period, our Admiralty included in their list all of this sort of light with the revolving lights. From the brief duration of the flashes, and the long interval between them, usually three or four minutes, they may not be observed, and, in some cases of hazy weather, or snow, or other adverse circumstances, be not made out, and thus the light might be mistaken for an ordinary fixed light. The flashes are sometimes coloured red. In the French light, where colour is employed as a distinction, it is very pale, but in our English lights, those thus shown, which are of such intensity as is considered to be a useful distinction, lose 0·8 of the whole incident rays, which enormous loss forms a great argument against the use of coloured media if it could be avoided. Green or blue shades are still more objectionable from their great absorptive powers.

The lamps which are used in these beautiful instruments are all more or less modifications of the cylindrical wicked lamp invented by Argand, in 1783. Those in use for reflectors are the same as they were left by the inventor himself. For the great dioptric lamp, various contrivances have been made for regulating the supply of oil to the compound burner.

For a first-order light, this lamp consisted, in the first instance, of four concentric wicks, of the respective diameters of 0·827, 1·69, 2·52, and 3·39 inches, the smaller apparatus being constructed of 3 or 2 concentric wicks; but within these last 7 years the interior wick has been dispensed with in all the burners, it being found that a light of superior brightness can be obtained by allowing more air to pass into the flame on the inside, and forcing this air outwards on to it by a metal breaker or button kept below the level of the flame, so as not to interfere with the rays of light emanating from all sides of it. This, though it rather increases the consumption of oil, produces a far better light. The oil is made to flow into the burners by various means, as is stated above. Fresnel's invention consisted of a series of four small pumps, worked by clock-work, which forced the oil upwards to the flames. Another mode was by weights acting on a piston; a third by a spring doing the same office, a plan which has since become in universal use in the moderator lamps. Another mode, the pneumatic lamp of Messrs. Wilkins, acted by means of the pressure of air in the reservoir, and another, frequently applied of late, is by placing the reservoir slightly higher than the lamp, the oil thus flowing freely by its own gravity to the required level.

The fuel used in the English lighthouses in these excellent lamps up to the year 1846, was the best sperm oil that could be procured. At that period a change was made throughout the whole of the lamps, by adapting them to the use of colza or refined rape-seed oil, requiring a thicker wick. This oil was in use in the French lighthouses for some time prior to this, and was procured from the seed of a peculiar species of wild cabbage, known in the north of France under the name of

colzat, or colza. This plant is extensively cultivated in Normandy, &c., the chief markets for the oil being Caen, Rouen, Lille, and Courtrai. That now used by the Trinity-house is chiefly refined by a patent process. This refined oil is of a superior character to the sperm oil; it produces a brighter flame, does not cause so much deposition on the wick, consequently, will burn much longer without trimming; any adulteration in it is much more easily detected than in sperm oil, and it is half the cost, although it has increased in value from 3s. 9d. per gallon on its first introduction, to 4s. 10d. at present. It is an excellent substitute for that oil, which is annually becoming dearer, and more open to being mixed with other and inferior oils. In the Liverpool lights olive-oil has been used since 1847—a change effecting a saving of 40 per cent. on the use of sperm-oil. In our colonial lighthouses other varieties of oil are used, of which one only need be noticed as being used in the lighthouses near the Cape of Good Hope. This oil is procured from the tips of the tails of the Cape sheep, and is said to be far superior to any other oil for brilliancy of light, but the quantity consumed, and the expense, are great. It costs 10s. 6d. per gallon, and the first-order light of Cape Agulhas consumes about 730 gallons a-year; 482 gallons of rapeseed-oil would be necessary for a year's supply.

One great advantage in the refined rape-seed oil is that it does not thicken, except upon a very great degree of cold, a qualification which places it far above sperm and many other oils for winter use. Indeed the change is a fortunate one in another respect. The untiring perseverance of the whale-fishers from the neighbourhood of Nantucket has so dispersed and destroyed their prey, that it is almost doubtful if a continuous and sufficient supply could be maintained, except at great prices.

The purity of the fuel, and the perfect combustion effected by the present arrangement of lamps, keep the flames used in the apparatus in their normal condition; but it is necessary to carry off the products of combustion from the confined space of the light-room, for, if they were not disposed of, they would both materially diminish the power of the light, and also be a serious detriment to the health of the attendant light-keeper, whose constant presence in the light-room is strictly required. This is effected by the ventilating tubes devised by Dr. Faraday, with the principles of which most are familiar; they are fitted to all our lighthouses. A plan, similar in action, but less complete in detail, was promulgated at the commencement of the present century by Dr. Van Marum.

As far as they were applied, then, the catoptric and dioptric systems, in use in the year 1847, acted perfectly; but still there was some waste of light, caused in one direction by the divergence of the instruments, and, in another, by their construction. The consideration of this loss of power led to the next steps in the science of pharology; since that period, some new arrangements have been proposed, by which some of the disadvantages of the dioptric system have been partially avoided. M. Letourneau proposed lengthening the duration of the great flash of the dioptric lens, by dividing it into two portions, and setting each half at a slight angle outwards; this would produce the desired effect, but it must be at the expense of brilliancy. Several other minor improvements also have been suggested, but the main features of the system have remained unaltered. There is some waste of light in both the systems. In the catoptric it is that angle comprised between the angle formed by the lips of the reflector and the flame and the horizontal ray which strikes the outer edge of the reflector. That portion of the light which passes upwards is, of course, lost for useful effect—the other portions may be considered as serviceable. In the year 1849 Mr. Thomas Stevenson proposed some arrangements which obviate this loss, upon what is termed the holophotal system.

The ordinary paraboloidal reflector is rendered holophotal as follows:—A small portion of the back of the reflector is cut off, behind the parameter, the line which passes through the focus; for this is substituted a portion of a spherical mirror of the same focus. In front of the flame a lens with three diacatoptric rings is added. The action of the spherical reflector is to return all the rays impinged on it back through the flame, and thus on to the posterior sides of the lens and diacatoptric rings. Therefore, all the rays which emerge from the lens, &c., will be horizontal, and the remainder, those impinging on the paraboloid, will also be reflected in the same direction. The Horsburgh Lighthouse, in the strait of Singapore, is fitted with 9 such holophotal reflectors—three on each face of a revolving frame, each side of which, it is said, gives as much light as five reflectors of the ordinary kind. This was completed in 1851. A similar apparatus, a red light of the same sort, was placed at Wick, in Caithness, in 1851.

Fresnel's revolving light system, as at work in the Skerryvore and the Cordouan, with its beautiful but complicated upper system, is rendered holophotal by a very simple means. The zones above and below the main lenses act in the same way as the centre, and, by the whole apparatus revolving, nearly the whole of the light is projected horizontally in the eight directions of of the octagonal prism. The diagram and the very beautiful fourth-order apparatus exhibited explains its action. Proceeding upon the assumption that the whole of the emitted rays from the central lamp may be made to assume the horizontal direction, Mr. T. Stevenson has made several most excellent arrangements, which, however, we cannot fully describe here. The simplest form is that of a hemispherical metallic reflector, in the focus of which is placed the lamp; before the lamp is a refracting polyzonal lens, of such a section that the whole of the direct rays from the lamp, and the reflected rays from the posterior reflector, are parallelised on their emergence. Carrying this principle to greater refinement, and as it was found that the totally reflecting glass prisms were effective compared with metallic reflections as 140 to 87, a hemispherical arrangement of glass is proposed, which, by refraction and total reflection, produces the same result as the metallic hemisphere in the former instance. The formulæ for the construction of this ingenious apparatus were calculated by Mr. Wm. Swan, F.R.S.E. The glass refracting mirror has one advantage over a metallic mirror in its powers of radiation, as in an experiment the heat in the interior of the apparatus was so great as to cause the oil to boil: an inconvenience, however, which was afterwards obviated mechanically. Very numerous other applications of his principle are also proposed.

M. Letourneau has proposed a simple arrangement of the fixed light with flashes, of the French system. It consists of alternate panels of horizontal and vertical lenticular elements, which, on revolving, show the alternate flash and fixed light without loss of power from the supplementary revolving lenses, as in Fresnel's arrangement. This may be readily exemplified by the beautiful apparatus before you, for, supposing that each alternate panel of this revolving light were made to consist of horizontal elements instead of circular ones, the effect would be first the flash from the circular face, and then the steady light during the period that the plane side was passing before the eye.

The effect of all these optical refinements is to send forth the light from our lighthouses in a thin disc or ray without vertical divergence; but with great deference it is urged that this may be overdone; for, suppose that the apparatus acts perfectly, and the thin disc of light should only osculate the horizon of its station, it is manifest that any observer in any other position than the exact circle of this horizon, will have to mount some elevation, in order to see the light at all, and that to any one passing within even a short distance of it the light will be invisible. Some amount of vertical diver-

gence is absolutely necessary, and the optical defect of the reflector becomes a real advantage. We may cite the recent melancholy example of the *Dunbar*, wrecked beneath the lighthouse at Sydney, which was intended or her safety, but could not be seen because it was overhead. Red panes of glass have been added to some of our lighthouses at the lower part of their lanterns in order to point out to ships coming into their effect that they are inside danger.

Up to this point, therefore, we may consider that our lighting is perfect; all future optical improvements can only be introduced on the score of economy, and any increase of power must arise from the source of light. All the powers of our lenses and reflectors aided by the most efficient lamps, are futile against the obscuring effects of haze or rain or snow, and to be able to conquer this difficulty in the least degreee will be the greatest step in the lighthouse economy.

The dioptric system does not appear to be adapted for floating lights as at present constructed. Mr. Wilkins and Mr. Letourneau have tried an arrangement of four lenses in front of the four lamps, behind which are spherical reflectors, being, in fact, a species of holophotal apparatus. But the great motion of the vessel prevents the possibility of keeping this apparatus constantly in a vertical position, a condition which is absolutely necessary for its proper action. Our light-ships are, therefore, still furnished with 12-inch reflectors, one of which is exhibited. These being mounted on gimbals, readily obey every motion of the ship, and by their great divergence (though consequent loss of light), obviate all those inconveniences which larger instruments would be subject to. But then these lamps and reflectors, up to this time showing a superior light to ordinary lamps, will not bear that comparison with those now used by steam vessels that they did in former years.

The Messrs. Chance, of Birmingham, the well-known glass manufacturers, have successfully competed with our French neighbours in the material as well as in the manufacture of the light-house lenses; and I believe their factories are the only place in this country where the operations are carried on to any extent. The fine and important light on Lundy Island, at the entrance of the Bristol Channel, is an example of their construction. It is a first-order holophotal apparatus, showing a revolving light. They are now engaged in making some important apparatus for our Trinity Board. It was believed that the glass could not be made in England so pure in colour, or rather with absence of colour, as to compare advantageously with that made near Paris, but these difficulties Messrs. Chance have overcome, and although I believe that some French material is employed, yet the improved processes have produced a result which compares well with the French apparatus shown in the French Exposition.

I now come to a very important point in the present subject. In 1832, Lieut. Drummond proposed the use of the now well-known oxy-hydrous light for lighthouse illumination, and an extraordinary instance of its power was given at the time, showing that a Drummond light, 70 miles off, appeared nearer to the observer than an ordinary lighthouse lamp and reflector 12 miles off, an irrefragable proof of its superiority if it could have been managed with certainty; but, notwithstanding the most careful study and the most ingenious contrivances, it has been found impossible to maintain the light with that steadiness which is absolutely necessary for lighthouse purposes.

Ten years since hopes were raised that the electric light would be so far perfected by Messrs. Staight and Petrie as to supply this most desirable improvement, but the difficulty in maintaining the light in its normal character led to its abandonment.

It has been carried to greater perfection under the arrangement of M. Duboscq, and is in general use in our philosophical experiments, but it requires delicate management. The principle is that of passing the electric current between two vertical pencils of carbon. I am much indebted to Professor Goodeve for kindly exhibiting this beautiful light, which, as you see, when applied to the holophotal lens apparatus, has a most powerful effect. Mr. C. W. Harrison has made a different arrangement, which obviates the inconvenience of maintaining the exact distance between the two poles, which is the main difficulty in the vertical lantern, by making the positive pole a cylinder of carbon, which, by revolving under the negative point, presents a constantly fresh point to the action of the current, passing in a spiral direction from one end of the carbon cylinder to the other. Its action is seen in the apparatus before you. I believe that this is the first time it has been exhibited in public, and certainly it has a very promising commencement.

There are two great difficulties in solving the problem of a steady light from electricity. The first is in maintaining an equable force from the producing elements, that is, the battery, which, of course, will gradually decline in power after a short time, and no means have, as yet, been devised for so thoroughly obviating this, as to keep up for so many hours as the light must be shown. The next is at the outlet of this current; in preserving that exact distance between the two points of carbon, through which the arc passes, which maintains the light in its normal condition. These carbon points are usually I believe, formed of graphite, the substance which is found lining the inner surface of old gas retorts. The rapid disintegration of the positive pole, the less diminution of the negative pole, and the irregularity of the consumption of both under the intense action, have baffled the ingenuity of almost all who have attempted to control them.

However, I am happy to say that I hear that the problem is about to be solved, and that ere long, probably, the electric light will be established at our finest lighthouse. This will be the greatest advance that has been made in pharology since the introduction of the existing system, which, in principle, may be said to have been perfect at the outset.

It is to the talent and patient ingenuity of Professor T. H. Holmes that we shall owe this grand improvement, and I much regret that the nature of the apparatus precludes the possibility of exhibiting it to you in this room, but those interested will, I dare say, soon have an opportunity of examining it elsewhere.

Mr. Holmes has adopted another form of originating the current than has hitherto been tried—that of magneto-electricity. The whole apparatus and its results are an admirable exemplification of the correlation of the physical forces—an evidence that one power may be traced throughout a train of operations until it emanates in a totally different form. The apparatus consists, I believe, of a series of very powerful permanent magnets, around the poles of which the helices are made to revolve by means of a steam-engine, and from the extent of the primary arrangement a most powerful magnetic current is produced, which, passing through the carbon pencils, shows that splendid light which entirely eclipses all other modes of illumination. I am not aware of the method by which Mr. Holmes regulates the distance between his electrodes, but the light exhibited last year, before the Trinity-house authorities, maintained a perfectly steady appearance for several hours, and doubtless might have been continued for any period. It is intended, I believe, to show the light from more than one point, so that it may be renovated without eclipsing it altogether, and even this changing of the electrodes is to be effected instantaneously.

This branch of our subject is worthy of the special attention of the Society of Arts, and an evening might well be devoted to the consideration of its merits. When once the system of illumination by electricity or any other similar light is practically established, we shall have an immense advantage in the capability of the lighthouse,

system for distinguishing one light from another, a desideratum which is even of more importance now than when the lighthouses were first placed on a proper basis—in fact this branch of it has remained nearly stationary from its origin.

The totally distinct character and colour of the electric light, will at once distinguish it at any distance from that derived from any other source. Therefore, supposing that this illumination be adopted as an adjunct to that in pressnt use, the stations in which it is applied will be distinguished from their neighbours without the chance of mistake, the fruitful source of accident from the present lights.

Respecting the power of the magneto-light, I have not met with any recorded photometric experiments applicable as a comparison; such comparison with the oil-lamps, however, could not be very well made. I have cited the experiment made by Lieut. Drummond; the electric light is more powerful than his light, and I am informed that its penetrative power through a hazy atmosphere is, as compared with the light apparatus in use, 75 to 1; so immense an advantage in the first principles of the utility for lighthouses cannot be overrated. The only comparison which can be made, as it occurs to me, is that afforded by the heliostat, the instrument for solar reflection used in extensive trigonometrical surveys. This reflection pierces the atmosphere to a vastly greater distance than the object from which it is shown, and might be taken as a measurement of the effect of this light.

In its use and in thus economising the power there must be some modification of the optical arrangements now in use. The light, not one quarter of an inch in diameter, would be entirely shut out by the frames of the lenses, or the bars of the light-room. It is probable that some refined arrangement of the Bordier-Marcet apparatus will be found to be the best, a specimen of which is exhibited. The action of the reflector I formerly explained. It was largely used in France, but, as far as I know, is only applied to one station in our own country, Ardvishaig, in the west of Scotland.

If a dioptric apparatus be chosen to economise this minute light, it must be of a very refined description, as any defect in it will be developed in its action on account of the smallness of the source of light, and any dioptric fringes, of course, will deteriorate its value, as the red or green rays, at a distance, might cause it to be mistaken for a red or green light. With more than one light, the chances of this will be avoided.

There would be no necessity for a light room for this light; a simple cylinder of glass, of sufficient diameter, would be the best form of protection, and a revolving wiper would keep the glass clear either within or without.

There is one proposition for distinguishing one light from another, which would be readily carried out if it were considered to be desirable, in electric illumination. It is that of the numerical distinction of Mr. Babbage. He proposes that each light should be masked at certain intervals, in such a manner that the light should tell its own number. Thus, being suddenly eclipsed three times at short intervals, then a pause, then twice suddenly eclipsed for a short period, would indicate No. 32, &c., the numbers to be arranged in a certain order. The simple breaking contact in the magnetic current will produce the eclipsing effect with the greatest facility and certainty.

Lieut. Raper, in his admirable work, proposes another method of showing a light for sea purposes, that is, by illuminating the clouds and haze over the station by the electric light. This shaft of luminosity might be inclined in various directions, or it might be made to revolve by proper optical arrangements, and this would give a great relief to the already exhausted resources for varying the appearances of lights; but there is one case which might render this system of no avail, and that is a perfectly pure atmosphere.

I wish now to draw special attention to another topic, which I think has a most important bearing on our present subject. It is the question of the lights carried by steam vessels, which I shall be able to show is daily causing more and more confusion in the capabilities of the lighthouse system, and by diminishing its efficiency is introducing a fresh element into its requirements.

On December 15th, 1847, the day on which my former paper was read, an order was issued by the Board of Admiralty, arising out of a careful series of trials and evidence, that all H.M. steam-vessels should be fitted with a bright light at the mast-head at all times, and when under steam to show, in addition to this mast-head bright light, a green light from the starboard-bow, and a red light on the port-bow. This system had been adopted previously by our principal steam-packet companies. On January 1st, 1852, an Act of Parliament came into operation which rendered it imperative on all steam-vessels to adopt the above system, which was also carried out by the governments of the principal foreign maritime nations. The object of the red and green lights, which are so screened as not to be visible except on their own sides, is to show to passing vessels the direction in which the steamer carrying them is going. In the Thames, above Yantlet creek, a more simple lighting of steamers is adopted, consisting of a foremast-head light, and a bright light at the bowsprit end or in the bows. These arrangements, if properly carried out, answer all the purposes required of them.

But the requirement has led to such improvements in the manufacture of these steamers' lights, that they rival in excellence and brilliancy the lighthouses and light-vessels that are established for their guidance, as may be readily comprehended by comparing the examples of these masthead lights which I am enabled to exhibit, with the reflectors of our light vessels. No judgment can be formed of the distance of a light, unless its absolute brilliancy be known, and there be no obscuration.

These excellent lamps may be, and constantly are, mistaken for the guiding lights on the shore, and many fatal examples might be cited of such an error. One very recent will suffice:—The *Lœander*, an American barque, proceeding down the St. George's Channel on the night of February 11th, 1858, saw a light, which was taken for that of the Tuskar Rock. It was afterwards discovered, when too late, that it was that of the screw-steamer *North America*. A fearful collision then took place, and the unfortunate ship and nearly all her crew were sent to the bottom in a few minutes.

In Mr. Wilkin's lamp the dioptric belt in the middle is precisely a portion of Fresnel's fixed light apparatus, and is of equal beauty with that refined system. Its action, after what has preceded, will be very readily comprehended. It is exactly a resemblance of a large lighthouse or a harbour light.

The question of steamers' lights is again under discussion, and a bill will be brought before Parliament forthwith for its further regulation, but the source of confusion I point to cannot be obviated, and it demands some consideration, in a primary sense, whether the whole system does not require revision. In the case of the Nore light-ship, the oldest of its kind, it was found necessary to change its fixed light to a revolving light; it could not otherwise be distinguished from the very numerous steamers so frequently at anchor near her, or passing in or out of the Thames. In some cases a red light has been added to the floating light, but this is ambiguous, as the steamer under way will carry the same appearance.

I have but little to add to my former paper, on the subject of the structures for exhibiting light. When Smeaton constructed the Eddystone, he established a principle on which all similar structures in our country, the Bell Rock, the Tuskar, the Black Rock, the Skerryvore, have been erected. The pile lighthouse in an exposed situation, as attempted at the Bishop Rock, the western-most of the

Scilly Isles, and on Minot's Ledge, Boston Bay, Massachusetts, have not been found to answer. Mr. Alexander Gordon, however, among the numerous colonial lights he has erected, and is still superintending, has introduced some new features. The fine iron tower on Bermuda has been copied for several other stations, one of which, for the Bahamas, till recently reared its head near the Regent's Canal. In a lighthouse now being built on the Roman Rock, Simon's Bay, Cape of Good Hope, he has made the flanges of the iron plates of the lower part of the tower external, and the spaces between these flanges are filled with Trinidad pitch, which affords a perfect protection from the action of the sea on the iron. He has proposed a tower with a leaden base for the dreaded Skerki Rocks, in the Mediterranean. In the important lighthouse of the Basses, on the south coast of Ceylon, an iron tower is constructed, around the base of which a granite casing, fitted together in this country, is being built, affording a martello-tower like protection from the tremendous sea, and a habitation for the keepers. A lighthouse with perpendicular sides perhaps would obviate some of the drawbacks to Smeaton's system. The sloping base of these towers leads up the waves, and in the case of the Eddystone, in 1838, the coping was much injured by an enormous wave, which mounted up the side of the tower. We might find numerous examples in nature of such a column withstanding the tremendous shock of the ocean-waves, one of which, the St. Peter or Black Rock, to the south-east of Japan, shown on the chart exhibited, affords a good example. The admirable wooden structure on the Eddystone, erected by Mr. Rudyard, in 1706, may also be cited. This might have existed to this day, but for its unfortunate destruction by fire in 1755. Mr. Gordon, in using wood as a material for lighthouses or their adjuncts, proposes to use Mr. Maugham's patent for its preservation. This consists in boiling the wood, for a few minutes, in a saturated solution of phosphate of ammonia, under a pressure of 20 lbs. to the square inch. The rationale of this process is, that every pore of the wood becomes saturated with oxygen, and therefore no chemical action of sea-water will tend to its decay.

I have thus described, briefly and imperfectly, the main features of our lighthouses—their progress towards perfection, and their present condition. All that I have alluded to is in present operation, with the exception of the electric light, and that may be said to be accomplished. I have shown that every refinement and economy in the illumination has been attained, and that more cannot be expected in that direction than we at present possess. All these matters refer to the progress and improvement of its details—I have had no new principle to describe to you, with the exception of that great step, the magnetic illumination; in other respects it remains the same as when William Hutchinson constructed his reflectors, or Rogers erected his lenses in the Portland or North Foreland lighthouse. In the meanwhile, another system, antagonistic to its efficiency, is daily growing into permanent importance. The wonderful advance of steam and auxiliary steam, as applied to our ships, developes a new phase in navigation, and our crowded channels are now traversed by this class of vessels, whose voyages are made and completed with the speed and certainty of our railway-trains. The pressure of modern times will not allow the commander of a steam-vessel to exercise that slow caution which was the safeguard of the mariner in former years. It was thought that, when all the dangerous points of our coasts were indicated by lights, that this "hand-rail" up the Channel would be a perfect help and security at all times. Now, however, each steam-vessel carries those false lights which, like those of the wreckers of former times, may only lure to destruction.

These considerations naturally lead us to revert to first principles—to enquire whether our lighthouses, as a system, are as near perfection as is required—if not, in what direction are we to look for future improvement?

The English and St. George's Channels are the greatest maritime highways of the globe, their dangers and difficulties are but a type of all others, but they are better known, and moreover they are, as has been observed, as "well-lighted as Regent-street." Yet an inspection of the two charts before you will tell a tale more impressive than any words I can say. The one exhibits the localities on which total wrecks only took place in the English and St. George's Channels, during the years 1852, 1853, 1854, 1855, and 1856. The other, of similar character, shows the localities where collisions (the growing evil) have occurred during the same period. A cursory glance at these charts conveys the same sort of information as does the enumeration of the killed and wounded in some great battle, yet each figure in the one, and every black dot on the other reveals an amount of personal misery, of suffering, and the entailment of such an accumulation of sorrow and privation to thousands, that each one of them might easily form the text of a thrilling tale.

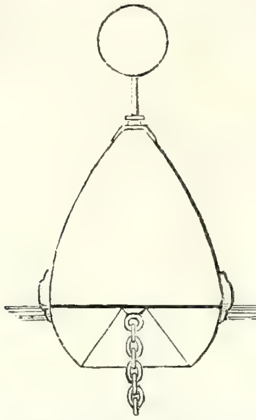
On a little closer examination a singular fact presents itself; it is, that the great majority of wrecks and collisions occur in the immediate vicinity of the lighthouses intended to guard against the dangers around them. There can be no doubt of this very important fact; and it may be readily accounted for by the universal practice of all ships, as far as possible, sailing along the coasts within sight of the lights, taking a fresh course at each point, when the general trend of the coast changes its direction. The numerous chances of error in a ship's reckoning then place it in constant peril from the proximity of the dangers it is desired to avoid. I have previously shown that our fixed structures have been pushed as far forward into the sea as human means could build them.

Many calamities have demonstrated that a mid-channel course, without very great caution, is a hazardous proceeding, especially to inward-bound ships. The reasons for this are, the varying direction and rate of the tides, which, however, are now better known and guarded against, and the local attraction of the ship herself upon her compasses. This latter unheeded source of danger has led to many losses; the mid-channel course is at right angles to the magnetic meridian, and, therefore, this element of erroneous reckoning is at its maximum. Its tendency in an up-channel course is to draw the ship's head to the southward, and hence the very numerous and distressing wrecks on the French coast, south of Boulogne, of which those of the *Reliance* and *Conqueror* may be cited as well-known examples. These disasters would have been averted had any fixed mark certified the commanders of their exact position and courses.

It is then, I believe, to floating structures we must look for future improvements in pharology. Our light vessels, as at present constructed, and as I have shown, are quite incompetent to fill any important station in the system.

The desideratum is supplied in the principle proposed by Mr. George Herbert, which I will briefly describe to you without going into those questions of wave-power and other collateral topics which may be well discussed elsewhere, or in alluding to the fallacies in principle which are at present applied to our floating beacons. The conditions required for a floating beacon are that it should keep upright to be most efficient, and for a floating light that it should, in addition to this, be free from any violent oscillation, such as is experienced by ordinary vessels. Mr. Herbert effects this by mooring his beacons which are of circular plan, from their *centre of gravity*, which is so arranged as to be nearly or quite on the line or plane of floatation. Beginning with the simplest form, that of a spiral buoy, as in the figure, the bottom of the body is hollowed out and raised up, and the mooring attached to the upper part of the cone.

Such buoys were brought into use by the Trinity Board, in 1854, and perfectly fulfilled the condition proposed.*



Proceeding higher in the scale of importance, Mr. Herbert proposes a refuge-beacon on the same construction, which may be moored in those places where a conspicuous seamark is imperatively necessary, and where the dangers around it call for some such aid for the shipwrecked mariner. A beacon of another construction, which proved serviceable in this way on the Goodwin Sands, was designed by Captain Bullock, and another by Mr. Walker. Mr. Herbert's plan is much more advantageous, as it would be placed outside the danger, and only a portion of the risk which would be incurred if it were on the danger would be encountered in reaching it. It consists of a circular base 20 feet in diameter, rising 2 feet 6 inches above the level of the water, on which a column rises to the height of 26 feet, the beacon itself drawing 5 feet of water. Around the deck or platform are stanchions, for the protection of those so unfortunate as to be obliged to resort to it. It is moored from its centre of gravity on the floating line, and must, if brought into general use, be of the greatest service in distant and exposed situations. Such a beacon was moored experimentally in 1854, on the overfall of the South-sand Head of the Goodwin Sands, in a position in which no vessel could have lived. It afterwards sunk. It was carefully watched by the master of the neighbouring light-ship, who states that the tide did not appear to have much effect on it; that the wind could not affect it to cause it to roll; that its motion was greatest in a short breaking sea; and that when he was on it he could not perceive any tugging on its mooring. The sea might have washed over its deck (2 feet 6 inches above the water), but never broke against the tower, a most important fact. It may have rolled about 5 feet out of the perpendicular, that is about 10 deg.; at the same time the light-vessel herself was washing about from side to side, her mast vibrating more than 26 deg. This vibration at times, and at some stations, is found to exceed 40 deg. from the perpendicular.

But the most important application of this excellent principle, will be in the establishment of floating lighthouses. If the stability and security of mooring a buoy of this construction be established, there can be no difficulty in extending the principle to any magnitude within the capability of engineering skill, which, as is familar in this room, is employed now to overcome difficulties far greater than that of securely mooring a body of the dimensions required for our purpose.

* In the River Hooghly, where the stream runs seven knots an hour, these buoys maintained a perfectly upright position, and they are being used to buoy the rapid rivers of Burmah and Siam. All buoys previously used in the Hooghly were carried under water by the force of the stream, their whereabouts being indicated only by a struggling on the surface of the water.

The outline of Mr. Herbert's proposed floating lighthouse as shown in the woodcut, is intended to show a light at an elevation of 40 feet, giving a range of 11 miles, or it may be raised to any elevation, say 80 feet, having a proportionately large base, which with the height of the spectator will give a horizon of 27 miles in diameter. The diameter of the base is 45 feet, and the draught of water 11 feet. The displacement is equal to 325 tons. It will be constructed wholly of iron, with all those contrivances now so well understood for ensuring very great strength, durability, and power of resistance. The one great essential that it shall maintain its position, is most carefully provided for. Four chain cables of the largest size and strength will be used, and by laying these in the different directions which experience will show to be those from which the severest strain will come, they will have but little strain in excess of their weight, and whatever that may be, it will only be necessary to compensate for it by diminishing the ballast in the floating base. The action of the waves upon the structure, when moored beyond the reach of the broken water, when the regular swell, however great, passes it, will only be to lift it vertically at regular intervals through a distance proportioned to, but not equal to, their height; thus the strain arising from this source can be readily calculated. It is proposed to use chains three inches in diameter, which it is believed will withstand a strain very many times greater than any to which they can be subjected. These chains pass over a windlass, which, with the central tube or hawse pipe, turns freely as a swivel on the middle of the body, so that the beacon may turn without twisting or fouling its chain. I need not dilate on the many ingenious methods devised for meeting any exigencies; suffice it to say, that all its parts have been successfully studied, and I have no doubt of the ultimate success of the proposition.

The tower will be of sufficient dimensions to carry the finest dioptric or catoptric light, and in all respects it can be established as efficiently as a structure on shore. A comparison of its dimensions can be made with those of the lantern of our present light vessels. This is given above on the same scale. The annual cost of maintenance not exceeding that of shore lighthouses.

With such an addition to our present system of lighting, how many difficulties will disappear, and how many advantages may be immediately placed for the furtherance of the progress and certainly of navigation. I will cite an instance: Lieut. Fraser, of the Bengal Engineers, has recently visited England to obtain information as to the best mode of proceeding to erect a lighthouse on the Alguada Reef, at the eastern promontory of the Bay of Bengal. This reef is about 12 miles from the shore, and just awash. It is very much in the way of passing vessels. To build a stone or iron lighthouse would be very expensive, but to place a floating lighthouse which would be equally efficient, would be a simple matter. It could be built here and put together in that country, and towed to its destination. Further, its keepers may be regularly relieved by the passing packet to or from Calcutta or Rangoon. If the lighthouse be on the reef there must be an establishment on the shore, here barren, inhospitable, and unhealthy, and should the weather be unfavourable, landing at the lighthouse would be impossible; in fact, it will be a second Eddystone or Bell Rock, with all their inaccessibility, and this moreover in the very unfavourable position of the Bay of Bengal.*

Although I have no more interest in this than what is induced by a favourite subject, I most earnestly trust

* There are many situations round the coast where the Floating Beacon would prove of greater service than the light on shore, as its position could in most cases be chosen according to the necessities of the case, irrespective of many considerations which must now often rule the selection of the site, and of necessity deprive the light of that full benefit it otherwise would afford.—*Naut. Mag.*, December, 1857, p. 677.—Capt. Bedford.

FIG. 1.

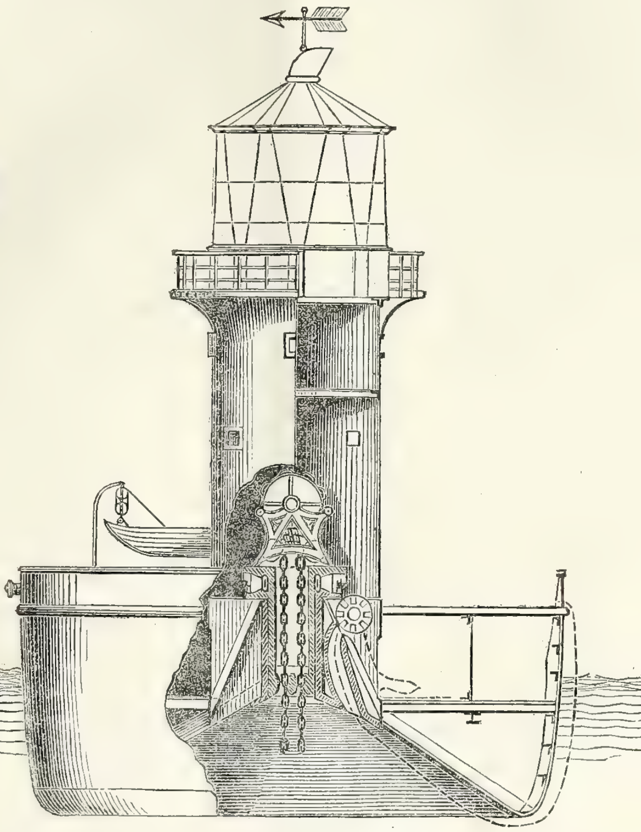
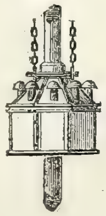


FIG. 2.



soon to see this principle of Mr. Herbert's practically added to our resources for navigation. There may be some hope of this, as I see in a parliamentary paper just issued, that the government authorities think it expedient and desirable that its practicability and efficiency be tested. I feel quite confident as to the result.

Now, as to its application to our lighthouse system, Mr. Herbert proposes to moor a series of these lighthouses in a direct line up the English Channel, and a similar line up the St. George's Channel. The outer light of the former channel will be 40 miles south-west of Scilly, on the parallel recommended for vessels to make for the Channel, but from which when now made, they are compelled to run within the reach of danger, in order to verify their position by sighting the lighthouses. From this point a line of these fabrics should be moored at each degree of longitude up to Dungeness, or eight lighthouses in all for the English Channel. Although their horizons will not, as proposed, overlap each other, that is, one will be lost sight of before the other is seen, yet they will be sufficiently near to each other for steam-vessels to steer their course by them with the utmost confidence. The same system applies to the St. George's Channel, as will be readily understood by the diagrams exhibited.

The outermost of the floating lighthouses would communicate by electric telegraph with the shore, and thus any want or announcement would be made instantaneously in the proper quarters, without the long delays now very frequent. Many other advantages might be placed within the reach of windbound vessels by such an establishment.

It is proposed that these lights should be of one exclusive character, differing from the shore lights. Either let them all be fixed, and alter those now fixed to varying lights, but I think it would be preferable, and I now suggest it, that the electric light, with its marked distinction, would be admirably adapted to develop the utility of such a system.

Such a line of lights once established, their utility is made manifest in a very few words. Let it be imperative, that all our steam vessels in going westward pass to the northward of those lights, and those steaming eastward, or up the Channel to the southward of them, leaving them in each case on the port hand.

These fairway lights would prove an invaluable acquisition to the mariner and the shipping interest at this period, by relieving the commander from that intense anxiety to avoid collision and danger, the chances of which now inevitably accompany his progress up these crowded channels; and we might then hope to see, in a future record of collision and wreck, a far smaller list of calamities than we now see crowded around our lighthouses.

These noble structures in all their utility would still be the safeguard of the coasting-trade, and of all ships not driven by the pressure of the times to sacrifice safety to speed.

With these remarks I close. I have endeavoured concisely to describe the past and present condition of our lighthouses, and to indicate what I believe will be the future direction for their improvement. As the talent and ingenuity of many have raised this beautiful system of applied science to its present high position, so it is

open to my auditors to endeavour to supply what may be now required as fresh necessities arise.

DISCUSSION.

Mr. George Herbert expressed his gratification at the notice which had been taken of his humble efforts in connection with the subject of lighthouses, which had been described in so lucid a manner as to leave nothing further to be explained. It only remained for him to express his thanks to Mr. Findlay for having brought this important subject so prominently before the meeting.

Mr. Matthews also expressed his obligations to Mr. Findlay for the able manner in which he had treated this subject. With reference to Mr. Herbert's system of floating lighthouses, he thought there could not be two opinions, for there was no doubt that the right place for lighthouses was the channel that ships must take, and until that plan was adopted they would not have the system in perfection. He begged to correct two slight errors into which Mr. Findlay had unintentionally fallen. The first was with reference to sperm oil being more easily adulterated than colza oil. It was quite the reverse. Sperm oil was the most difficult to adulterate, on account of its being of much less specific gravity than any other burning oil with which they were acquainted. The second point he would notice was, that Mr. Findlay had attributed the invention of the deep reflector to Mr. Thomas Stevenson. The entire apparatus described in the paper was patented and employed, and the patent had expired some years before Mr. Alan Stevenson published his work, giving an account of the invention that had been attributed to Mr. Thomas Stevenson. Had he been aware that it was the intention of Mr. Findlay to touch on this portion of the subject, he would have brought with him one of the deep reflectors originally designed by Mr. Alexander Gordon, which, he believed, would be found to be identical with that described in the paper, and from which a greater light was obtained than from the reflector of Captain Huddart. He had the testimony of Mr. Brookin, one of the Newfoundland Lights Commissioners, that a face of three of these deep reflectors was capable of being seen, in all states of the atmosphere, at a distance of over 30 miles, and he knew of no other description of reflector of which, with the same number of faces, the same results could be recorded.

Mr. William Hawes remarked, that the very able paper to which they had listened, gave rise to ideas interesting to this Society. It had been shown that up to a recent period the glass reflectors of France were of a superior description to those of this country, but since the duty on glass had been abolished, so rapid had been the improvement in that branch of manufacture, that Messrs. Chance now made reflectors equal, if not superior, to anything that had been produced on the continent. This was one practical illustration of the effect of Excise regulations upon the manufactures of this country, and one which ought not to be passed over unnoticed by the Society of Arts. The next point to which he would allude was, that by the new system of lighthouses proposed, the warnings were to be placed, not in places of danger, but in situations of safety. The map before them exhibited the extraordinary anomaly that where lighthouses most abounded, the greatest number of casualties had occurred, and it would really seem that lighthouses, under the present system, attracted ships into the very danger that they sought to avoid, and that in the search for the lights the vessels approached nearer to the point of danger than would be the case if those warnings had not to be sought after, particularly in bad weather, when the risks of navigation were immeasurably increased. He, therefore, attached the greatest importance to the proposition to establish lighthouses in positions of the *greatest safety* instead of in those of the *greatest danger*, the search for which led to the misfortune they were intended to provide against. The final success of a system, the desirability of which he thought everyone would admit, was, therefore, dependent upon the construction of such vessels as could be moored in mid-channel, in deep water, so securely as to be almost beyond the possibility of accident arising from the effects of the most violent storms. If that could be effected,—and our naval architects and engineering skil had surmounted far greater difficulties,—he thought there could not be two opinions as to the great practical value of the system propounded by Mr. Herbert, which, he considered, ought to be adopted in those great highways of navigation, the St. George's and the English Channels.

Professor Goodeve then exhibited M. Duboscq's arrangement of the electric light, and gave a description o the apparatus. Mr. Harrison's lamp for producing the electric light was also shown.

Mr. Varley desired to add his testimony to that o Mr. Hawes as to the great importance of placing lighthouses in situations of safety, instead of their serving, as under the present system, to attract into danger.

The Chairman said it was now his pleasing duty to propose a vote of thanks to Mr. Findlay for his excellent and highly interesting paper, including also in that acknowledgment Professor Goodeve and the other gentlemen who had exhibited the various electrical apparatus which had afforded them so much entertainment. Mr. Harrison's plan of producing the electric light had been for the first time publicly exhibited that evening. He was sure they must all feel that the idea of having lighthouses in the centre of the channel instead of on the coast, was a most valuable one, and deserving of the serious attention of the authorities. It was, in fact, recognising the plan adopted for the safe conduct of the traffic of the highways on land, that the traffic going in one direction should pass on the right hand, whilst that going in the contrary direction should proceed on the left hand; and the introduction of such a system in maritime affairs could not but be productive of the greatest benefits in the way of security from casualties. Mr. Hawes had glanced at the results which followed from the abolition of the excise duties upon glass, to which were to be mainly attributed the recent advances in the manufacture of that article. He hoped the relaxation of excise duties would be carried still further, particularly with reference to the duties on paper. It seemed to him a strange anomaly, that, whilst they were voting hundreds of thousands of pounds for the advancement of education in this country, they still maintained the excise duty upon paper, which virtually defeated the objects of the educational votes. He begged to propose a cordial vote of thanks to Mr. Findlay, as well as to those gentlemen who had so ably assisted in illustrating the subject.

The vote of thanks was then passed.

Mr. Findlay expressed his sincere gratification that his treatment of a subject, which he had taken up merely as an amateur, had met with the approbation of the meeting. In the notice which he had given of the plans of Mr. Herbert, he thought no greater prominence had been given to them than they were entitled to. The only question was whether such a structure could be moored so as to withstand all the casualties to which it would be subjected at sea, and upon that point he thought there was very little room for doubt. The imperfections of the present lighthouse system must be apparent to all. At present the lighthouse between the Scilly Islands and the Land's-End, gave no better light than that which was ordinarily carried by first-class steam-vessels, and the chances of casualties were thereby very much increased, as one light might be mistaken for another. He thought the magneto-electric light, which he had referred to, would be well adapted for the new system of lighthouses along the channels, and if that were adopted it could never happen that a ship's light could be mistaken for that of a lighthouse. What was required in the traffic of the channels was, a system

like that which had been so successfully adopted on London-bridge—that the slow traffic should pass by the sides each way, whilst the quick traffic took the middle line. By the adoption of such a system, the casualties incident to intermingled traffic were entirely avoided.

The paper was illustrated by numerous specimens of lighthouse apparatus and ships' lamps, exhibited by Mr. W. C. Wilkins, Messrs. Olivers, and Dr. Browne. Duboscq's apparatus for the electric light was kindly lent and shewn by Professor Goodeve, of King's College. In this arrangement the distance between the electrodes is regulated by clockwork, controlled by a detent in connection with an electro-magnet, acted upon by the battery current. Mr. C. W. Harrison also exhibited his arrangement for producing a continuous electric light. This is effected by constructing one electrode of a cylinder revolving, and, at the same time, having a motion parallel to its axis. The other electrode is fixed, and is thus brought successively opposite a fresh portion of the cylinder.

The Secretary announced that on Wednesday Evening next, March 10, a paper, by Mr. Henry Ashworth, "On Cotton: its Cultivation, Manufacture, and Uses," would be read.

SOULAGES COLLECTION.

The following is the petition which is about to be presented to Parliament, by the Royal Institute of British Architects, in favour of the purchase of this collection by the nation:—

To the Honourable the House of Commons in Parliament assembled.

This the humble prayer and petition of the President and Council of the Royal Institute of British Architects (incorporated 7th William IV.)—

Sheweth,—That whereas a certain Collection of Works of Art and Vertu, commonly known as the Soulages Collection, has been brought to this country at the sole charge and risk of certain patriotic individuals, moved to prevent its dispersion, and to enable it to be secured for our national museums, at a moderate price, which would leave no profit to those individuals, who altogether repudiate the desire for any gain, provided that the collection be acquired and kept together for purposes of public instruction in this country.

That, whereas the Council of the aforesaid Institute of British Architects, immediately on the arrival of the said collection in this country, appointed a committee of members of the said Institute, eminently qualified to estimate the artistic value of the objects forming the said collection, to examine and to report upon the same.

That, whereas the said committee, after diligent investigation and examination, made an unanimous report, most earnestly recommending the expediency of a purchase of the said collection for national purposes, and setting forth the great benefits that would, in their opinion, accrue to the art and industry of this country from such purchase.

That, whereas the Council of the said Royal Institute of British Architects did receive and unanimously adopt the said report, which they caused to be read at an ordinary general meeting of the said Institute, held on the ninth day of February, in the year of our Lord one thousand eight hundred and fifty-seven, when it was received, unanimously adopted, and copies of it directed to be forwarded to the principal members of Her Majesty's Government.

That, whereas the aforesaid Council and Committee of the aforesaid Institute, moved by their great anxiety that the said collection should not be dispersed, when the valuable and beautiful objects of which it consisted would be lost for purposes of general study and national improvement, but that it should be acquired by Government, in order to be exhibited gratuitously to the public, and to afford at all times a treasury of instruction to artists and workmen, did, on the sixteenth day of December, in the year of our Lord one thousand eight hundred and fifty-seven, attend as a deputation upon the Right Honourable the Lord President of the Committee of Privy Council on Education, to urge upon him most strenuously the important interests they conceived to be affected by the question of the said purchase.

And whereas your petitioners concientiously believe that benefits, greatly outweighing any consideration of the sum of money to be expended in the purchase of the said collection, would speedily result to the development of the great commercial interests connected with the progress of art-industry in this country, in the event of the said purchase being effected.

This petition now, therefore, humbly prayeth, that your Honourable House will be pleased to take these matters into your gracious consideration, and devise such steps and proceedings as may cause the said colleetion to be purchased and freely exhibited for the benefit of the community at large, and of those more immediately connected with arts and manufactures in particular.

And your petitioners, as in duty bound, will ever pray.

(Signed)
DE GREY, President.
C. C. NELSON, } Hon.
M. DIGBY WYATT, } Secs.

16, Lower Grosvenor-street, London.

SOUTH KENSINGTON MUSEUM.

During the week ending 27th Feb., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 3,519; on Monday and Tuesday, free evenings, 3,912. On the three Students' days (admission to the public 6d.), 975; one Students' evening, Wednesday, 344. Total 8,750.

Home Correspondence.

THE SEWAGE OF LONDON.

SIR,—Mr. Allnutt having mentioned my name, in his paper on "The Sewage of London," in a recent number of the *Journal*, I hope you will allow me space for a few remarks on this important subject. The sewage problem embraces two questions, quite distinct, yet closely connected—1. How is the nuisance arising from the decomposition of organic matter to be got rid of? and 2. How is the waste of fertilising matter, from the escape of sewage into rivers and the sea, to be prevented? Both questions are, I believe, satisfactorily answered in the plan which I submitted to the government referees on Metropolitan Drainage, and which was printed by them in the appendix to their report. In this plan it is proposed to effect the complete and immediate removal of the excrements of the population, by means of the smallest sufficient quantity of water, through a system of earthenware pipes, laid down for the purpose, to force this concentrated sewage through pipes into the country, and to distribute it there in the way recommended by Mr. Chadwick.

The nuisance arising from sewage is occasioned by the decomposition of excrementitious matter, and this again is in great measure owing to the retention of the more

solid part of the sewage in ill-constructed house drains and sewers. By removing all excrementitious matter immediately and completely, and placing it in contact with the soil before decomposition takes place, all the evils that arise from the decomposition of organic matter, under, or in the neighbourhood of, human habitations, are avoided.

Again, by reducing the water in which the excrements are suspended, to the smallest quantity by which their complete removal can be effected, we get rid of the great obstacle to the utilisation of sewage, its great bulk and low value. If we take the daily supply of water to the inhabitants of London at 25 gallons per head, and leave the rainfall out of view altogether, the average annual amount of sewage per head will be 40 tons, and as these 40 tons of sewage contain a quantity of fertilising matter worth 6s., the value per ton is only 1¾d. But it costs 2d. per ton to distribute sewage according to Mr. Chadwick's plan, consequently the utilisation of sewage of this degree of strength, or weakness rather, is impossible, and, if we dilute the sewage still further, by the addition of 40 tons of rain-water, it becomes doubly impossible. Suppose, now, that by using one gallon of water per head per diem, we can sweep the excrements of the population through the earthenware pipes we have laid down, the annual amount of this concentrated sewage would not much exceed two tons per head, and its value would rise to 3s. per ton, from which the expense of distribution, supposing it to amount even to 6d. per ton, would form a trifling deduction.

The referees, in their report, state some objections to "the proposed construction of a system of drains for house sewage, and another system for rainfall," which, as they may be brought against this plan, deserve to be noticed here. The first objection is that the water which flows from the streets of London contains foul organic matter to a serious extent, that there is no such difference between metropolitan surface-drainage and house-sewage, as to justify the one being removed from the river, while the other is still permitted to flow into it. Also, that the rain falling on the roofs and yards of buildings, is subject to a vast amount of contamination, that much objectionable matter is washed out of the yards of manufactories, and from the various stables, mews, cowhouses, and other places during rain; that quantities of slops are discharged into the house gutters, and that the water-closets are in many houses connected with the rain-water pipes. Now, if we examine Professor Way's analyses of street-drainage water, we find that the quantity of soluble organic matter contained in it is so small as not to be stated separately. It appears also, from his examination of water collected from the roofs of houses, that water thus collected in London is of half the impurity and half the hardness of Thames water, and that the small quantity of soluble matter which it contains, consists principally and almost wholly of sulphate of lime. (Appendix iii. to report of General Board of Health, on Supply of Water to the Metropolis, p. 142.) We may therefore safely assume with Mr. Lawes (*Journal*, vol. iii, p. 264) "that the great bulk of the excrements of horses, cows, &c., in the metropolis, will not find its way into the sewers; that the refuse of manufactures, valuable as manure, which will do so will be comparatively limited, and that the matters abraded from the streets, with their small admixture of the excrements of horses and other animals, will also be of comparatively little value" or importance. The second objection, founded on the difficulty of introducing a fresh system of drains from the large number of gas and water pipes under the streets, and the numerous cellars, vaults, and works of similar construction, has been met by Mr. Allnutt. The third objection is the expense and difficulty of constructing separate drains, and ensuring a separation. If this plan succeeds only to the extent of the receipts covering the expenditure, this objection falls to the ground. Difficulties will have to be met and overcome whatever plan is adopted, but the difficulties attending this plan, are at least not more formidable than those attending any other.

We now proceed to state some objections to the plan proposed by the referees.

1. This plan does not meet the requirements of the Act, by which it is provided that the Metropolitan Board of Works "shall make such sewers and works as they may think necessary for preventing all or any part of the sewage within the metropolis from flowing or passing into the river Thames, in or near the metropolis." "And the said Board shall cause the sewers vested in them to be constructed, covered, and kept, so as not to be a nuisance or injurious to health." The Act recognizes two sources of nuisance and injury to health,—the pollution of the Thames, and the deposit of decomposing organic matter in the sewers. This plan deals only with the former. The act requires works to be constructed for preventing any part of the sewage of London from passing into the Thames. The referees are of opinion that a sufficient provision will have been made for rainfall in the urban districts, if the sewers of those districts are made capable of removing two-fifths of an inch of rain during the eight hours of maximum flow. They are of opinion that an amount of dilution equal to six times the maximum flow of the sewage, is the lowest point at which it is advisable to admit storm waters into the river. Unfortunately, it happens that when a fall of rain causes a flow of mingled rain water and sewage, equal to six times the maximum flow of sewage in dry weather, the resulting mixture instead of being diluted and, consequently, weaker than ordinary sewage, is much stronger. It was found in one case to contain more than double, in fact, nearly three times the amount of impurity contained in specimens of ordinary sewage. Suppose after a month's dry weather a thunderstorm takes place, and an inch of rain falls in an hour, as sometimes happens, the channels provided by the referees are incapable of removing one-fifth of the water that runs into the sewers; the remaining four-fifths are discharged into the Thames, carrying in suspension an amount of decomposing organic matter exceeding that contained in a month's ordinary sewage. The consequent pollution of the river, when it occurs, is none the less disagreeable or injurious to health, that, after an expenditure of six millions of money, it occurs only at intervals.

2. This plan cannot be carried out without great risk to the health of the inhabitants of the metropolis. "The construction alone of these sewers and their numerous tributary branches," says Dr. Copeland, "must prove a most serious matter to the inhabitants of the streets through which they are carried. The trunks especially must be both deep and large, and, consequently, the quantity of earth saturated with, and rich in the product of, animal decay, through the lapse of centuries, that will be thrown up during these constructions, and exposed to the action of the atmosphere and to the influence of the sun, must be productive of terrestrial emanations, calculated to generate a fatal typhoid epidemic of long continuance. London will be as deeply, more generally, and not less fatally, cut up into trenches than the grounds surrounding Sebastopol." (On the Drainage and Sewage of London and Large Towns.)

3. This plan will create a nuisance rivalling that which it is intended to prevent. The reservoirs, the 18-mile streams of sewage, covered or uncovered, will not smell very sweet.

4. The plan contains no provision for the utilisation of the sewage. It takes away any remaining chance of its being utilised, by diluting it still farther. A velocity of two feet six inches is required in the outfall channels to prevent deposit. This velocity, however, could not be maintained unless the channel were nearly full of water; but the amount of the maximum flow of the sewage during dry weather is not much more than one-sixth of the quantity to be removed during rain. We propose, therefore, to obtain from the Thames at high

water the necessary quantity to fill the outfall channels during those times when the flow of sewage is not sufficient to give the required depth and consequent velocity. —(Report, p. 34.) The sewage which in dry weather is worth, as we have seen, seven farthings per ton, comes, when diluted with six times its bulk of water, to be worth just one farthing per ton, and will continue to flow into the German Ocean.

To sum up, the plan of the Government referees does not ensure the complete purification of the Thames; it leaves the sewers of the metropolis in *statu quo*—that is, in dry weather accumulating deposits of foul organic matter, which the first heavy rain washes into the river as before; it does ensure that the loss of fertilising matter, to the value (as they say) of £1,000,000 sterling per annum, shall continue.

The plan which I have proposed, on the other hand, contains a remedy for both evils—the evil of nuisance, and the evil of waste. The utilisation of the sewage, the purification of the Thames, and the effectual drainage of the metropolis, are all provided for, and——the sewage problem is solved.

I am, &c., ALEX. LESLIE.

Turriff, Aberdeenshire.

NEW ZEALAND AND ITS RESOURCES.

Sir,—In the discussion on Mr. Stones' paper, given in the *Journal* of last week, I am reported to have said, "The reason why the New Zealand flax had been so little taken up was, from the fact that it came over heckled, and the yellow bark which had a deteriorating effect upon ropes made from it was not got rid of." It should have been, "The reason why New Zealand flax had been so little taken up was, from the fact, that when heckled only, the yellow bark, in a great measure, remained, so that a three-inch rope with the bark-like substance on would only make a two-inch rope if properly cleaned."

I am, &c., E. W. TRENT.

Brookby's-walk, Homerton, March 2, 1858.

DISEASED BEERS.

Sir,—The above heading having just caught my eye in the *Journal of the Society of Arts*, I may be excused for making a remark or two upon it. The use of the products of sulphur for brewery utensils is by no means a new thing, as I myself used it very largely some 25 years since—that is, diluted sulphuric acid, which was applied to a large quantity of butts about to be taken down, without any certainty as to when they might be required to be put together again. The plan answered thoroughly; but, how far it would be wise or prudent to use, for casks or brewery utensils generally, such a process, must be left to the judgment and taste of those more immediately concerned.

As it is well known that I have given many years' study to the seasoning of all kinds of wood, and brewers' casks as well, I trust I may be excused for saying, as regards the latter, that a rapid current of highly-heated air to the inner surface, according to the plan which met with the "golden" approval of the Society of Arts eight or nine years ago (and which, I may add, has been successfully applied to many millions of casks since that period), is much safer, cleaner, and altogether better than placing in the hands of perhaps careless labourers the use of any such element as that already referred to.

I am, &c., ROBERT DAVISON.

8, London-street, City, Feb. 24, 1858.

To Correspondents.

The members of the Pottery Mechanics' Institution, Hanley (late Shelton), Staffordshire Potteries, wish it to be notified that they still agree to an "Interchange of Privileges" with other Institutions.

Mr. Theophilus Heale, of 117, Bishopsgate-street-within, wishes to contradict the statement made by Mr. Stones, in his paper on New Zealand, to the effect that the works at the copper mines of the Great Barrier Island are not being carried on. Mr. Heale states that they have never been suspended for a single day since they were undertaken by himself and Mr. Whitaker in 1851, and that he considers the yield satisfactory.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 23rd, 24th, 25th, and 26th February, 1858.

54. Metropolitan Police—Accounts.
68. 1. Trade and Navigation—Accounts (31 Jan., 1858).
86. East India (North Western Provinces, &c.)—Return.
40. Schools (Scotland)—Returns.

MEETINGS FOR THE ENSUING WEEK.

Mon. Medical, 5. Anniversary Oration.
Architects, 8. Rev. J. L. Petit, "Remarks on Byzantine Churches."
Geographical, $8\frac{1}{2}$.

Tues. Royal Inst., 3. Prof. Huxley, "On Biology."
Syro-Egyptian, $7\frac{1}{2}$. Mr. Jos. Bonomi, "On the Identification of certain Musical Instruments represented in the Sculptures of Nineveh, with those mentioned in the 3rd Chapter of Daniel, and in the 150th Psalm."
Civil Engineers, 8. Renewed Discussion, "On Submerging and Repairing Telegraphic Cables."
Med. and Chirurg., $8\frac{1}{2}$.
Zoological, 9.

Wed. Literary Fund, 2. Anniversary.
Society of Arts, 8. Mr. Henry Ashworth, "On Cotton: its Cultivation, Manufacture, and Uses."
Geological, 8. I. Mr. Redaway, "Notes on the Gold Fields of Victoria, &c." II. Mr. Phillips, "Notes on the Gold Fields of Southern Australia." III. Mr. A. R. C. Selwyn, "On the Geology of the Gold Fields of Victoria."
Graphic, 8.
Archæological Asso., $8\frac{1}{2}$.
Royal Soc. Lit., $8\frac{1}{2}$.

Thurs. Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Antiquaries, 8.
Royal, $8\frac{1}{2}$.

Fri. Astronomical, 8.
Royal Inst., $8\frac{1}{2}$. Dr. W. B. Carpenter, "On the Lowest (Rizopod) Type of Animal Life, considered in its relations to Physiology, Zoology, and Geology."

Sat. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Feb.* 26, 1858.]

Dated 20th January, 1858.

98. C. Davage and T. Davage, Sheffield—Improvements in railway crossings.

Dated 28th January, 1858.

152. P. Bussi, 38, Cannon-street—An improved railway carriage. (A com.)

Dated 6th February, 1858.

223. G. Davies, 1, Serle-street, Lincoln's-inn—Improvements in the preservation of meat and other animal and also vegetable substances. (A com.)

Dated 9th February, 1858.

244. B. B. Wells, 431, Strand—Improvements in apparatus for counting and indicating numbers.
245. R. Carte, 20, Charing-cross—Improvements in clarinets.
246. E. Stevens, Cambridge-road—Improvements in machinery for preparing dough, paste, and like articles.

Dated 10th February, 1858.

249. G. J. Ping, Chard, Somerset—Improvements in machinery for the manufacture of bobbin net and netted fabrics.
250. R. Aytoun, Edinburgh—Improvements in safety cages or apparatus for mines.
251. W. Palmer, Sutton-street, Clerkenwell—Improvements in lamps.
252. J. Chatterton, Devonshire-street, Islington—An improvement in electric telegraph wires, and in insulating telegraph wires.
253. J. Nasmyth, Lille, France—Improvements in the mode of obtaining motive power, and of applying it.

Dated 11th February, 1858.

254. A. Chambers, Canterbury, and W. H. Champion, Lynsted, Kent—Improvements in railway breaks.

255. L. Cass, Bury—Improvements in steam engines and steam engine boilers, and in apparatus connected therewith. (A com.)
256. R. Bell, Gracechurch-street—An improvement in stable pans, sinks, and urinals.
257. G. A. Barrett, W. Exall, and C. J. Andrewes, Reading—An improvement in the manufacture of perforated beaters for thrashing machines.
258. B. Looker, junr., Kingston-on-Thames—Improvements in sockets for receiving telegraphic and other posts or up rights.
260. G. W. Burton, Dubuque, Iowa, U.S.—An improved method of manufacturing white lead. (A com.)
261. J. R. W. Atkinson, Leeds—An improved mode of tightening up and unscrewing binding nuts and screws.
262. W. Keatinge, Merrion-square, Dublin—Improvements in correcting variations in the mariner's compass from local attraction.
263. G. Thorrington, Old Windsor—A novel method of propulsion, applicable to agricultural purposes.

Dated 12th February, 1858.

264. W. N. Wilson, 144, High Holborn—Improvements in machines for cleaning and polishing knives. (A com.)
265. W. N. Wilson, 144, High Holborn—Improvements in washing and wringing machines. (A com.)
266. J. C. Fisher and J. Booth, Blackburn—An improved mode or method of driving mule spindles.
267. J. Horsey, Greek-street—An improvement in india rubber and other elastic band or ring fastenings.
268. J. Clifton, New Oxford-street—A new article of nursery furniture or gymnastic exercising chair and support for children. (A com.)
269. T. Neville, Lichfield, and W. S. Dorsett, Aldridge, near Walsall—Improvements in steam boilers or steam generators, and in steam engines.
270. T. Neville, Lichfield, and W. S. Dorsett, Aldridge, near Walsall—A new or improved method of constructing and actuating horizontal water wheels.
271. A. V. Newton, 66, Chancery-lane—An improved construction of sewing machine. (A com.)
272. A. V. Newton, 66, Chancery-lane—Improved machinery for stitching or working button-holes. (A com.)
273. W. C. T. Schaeffer, Stanningley, near Leeds—Improvements in obtaining fatty and oily matters from wash waters, or waters containing soap.
274. J. Macintosh, North Bank, Regent's-park—An improvement in treating articles of gutta percha made or formed in dies or moulds, also certain articles of gutta percha made by expressing through dies, and also articles of gutta percha made by pressing rollers.

Dated 13th February, 1857.

276. J. E. Ryffel, Wimbledon—The improvement of stoves, for the purpose of warming rooms and baking bread, called the "hygean stove."
277. J. C. H. Sievier, Upper Holloway—Improvements in submarine conductors of electric telegraphs.
278. E. D. Johnson, Wilmington-square—An improved construction of chronometer case.

Dated 15th February, 1858.

279. W. Spence, 50, Chancery-lane—Improvements in telegraphic apparatus. (A com.)
280. J. McDermid and J. McDermid, Oak Tree, Middleton-one-row, near Darlington—An improved apparatus or contrivance for supplying water to buildings and dwelling houses for sanitary purposes, and for the extinction of fire.
281. P. M. N. Benoit, Paris—An improvement in counterbalancing the pressure exerted by the steam against the slide valves of steam engines of all kinds.
282. E. Hunt, Walnut-tree-walk, Lambeth—Improvements in voltaic batteries, and in means for producing the electric light.
283. G. T. Bousfield, Loughborough park, Brixton—Improvements in the preparation of dough for bread, pastry, cake, and other farinaceous articles of food. (A com.)
285. J. Tall, 150, Blackfriars-road—Improvements in that description of carriages called perambulators.
286. M. Crawford, Elswick Iron Works, Newcastle on-Tyne—An improvement in the manufacture of furnace bars.
287. G. L. Blyth, Derby-street, Parliament street—An improvement in the manufacture of manure from sewage waters and other fluids containing ammonia or nitrogenous matters.
288. W. Cope, Nottingham—Improvements in the manufacture of fabrics by bobbin-net or twist-lace machinery.
289. H. J. Sanders and S. Thacker, Nottingham—Improvements in machinery for the manufacture of textile and looped fabrics.
290. W. E. Newton, 66, Chancery-lane—Improvements in treating certain oils and fats, so as to effect the separation of constituent parts of such oils and fats. (A com.)
291. J. Garnett, Otley—An improved manufacture of paper.

Dated 16th February, 1858.

293. H. Wilde, Manchester—Improvements in connecting the ends of lightning conductors, and also the ends of submarine electric telegraph cables.
294. W. Armitage, Manchester—Improvements in looms.
295. T. B. Daft, Liverpool—Improvements in instruments for rubbing out pencil marks and for sharpening pencils.
296. M. A. F. Mennens, 4, South street, Finsbury—Certain improvements in voltaic batteries. (A com.)
297. A. V. Newton, 66, Chancery-lane—Improved apparatus for laying submarine telegraph cables. (A com.)

Dated 17th February, 1858.

300. J. E. Boyd, Hither-green, Lewisham—Improvements in lawn and grass mowing machines.
301. G. Baker and J. E. Baker, Birmingham—New or improved machinery for compressing and moulding powders and pastes.
302. P. Heyns, 2, Wades-place, Poplar—Improvements in wheels and axleboxes.
303. R. Varvill, Manchester—A certain improved apparatus for washing clothes or articles of wearing apparel.
304. W. Riddle, 4, Stonefield-terrace, Liverpool-road—Improvements in apparatus for binding and fastening bales and other articles.
305. The Hon. W. H. Yelverton, Whitland Abbey, Carmarthenshire, and Owen Bowen, Great Queen street, Westminster—An improved manufacture of coke.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

248. W. S. Clark, Atlas Works, Dorset square—Improvements in copying presses. (A com.)—10th February, 1858.
299. C. Monson, Connecticut, U.S.—A new and useful mechanism or apparatus, to be used for supporting one or more gas burners, and conducting gas to such, or for various other useful purposes.—17th February, 1858.

WEEKLY LIST OF PATENTS SEALED.

26th February.
2277. R. Whittam.
2285. H. Brinsmead.
2293. G. W. Lenox.
2296. E. Taylor.
2299. E. Leigh.
2300. T. Hardcastle.
2301. T. W. Roys.
2303. J. Petrie.
2306. T. Jackson.
2307. J. R. Atha, W. Pearson, and W. Spurr.
2311. L. Moreau.
2319. J. Nuttall and L. Stean.
2327. P. A. le Comte de Fontainemoreau.
2328. S. Butler.
2331. T. Goodchild.
2335. C. J. Duméry.
2479. A. V. Newton.
2735. W. Clark.
3065. J. de Normann and W. T. Henley.
3100. J. E. Barton.

2nd March.
2304. G. F. Parnell.
2313. T. Pettijean.
2314. C. W. Ramié.
2320. U. Scott.
2322. R. Johnson.
2338. G. J. Mackelcan.
2360. W. Clark.
2362. J. Harrison.
2380. T. Waterhouse.
2392. T. Archer, junr.
3144. E. Maw.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

22nd February.
400. J. Norton.
408. V. J. Lebel, J. Fourniol, and J. B. Remyon.
413. J. S. Russell.

23rd February.
402. W. H. Zahn.
421. C. H. Roberts.
547. J. Malcomson, R. Shaw, and W. Horn.

26th February.
422. T. Nash, junr.
436. J. Brickles, T. Thorpe, and J. Lillie.
441. G. M. Miller and J. Wakefield.
445. H. C. Jennings.
454. G. M. Miller.
468. J. Coney.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4060	Feb. 22.	Improved Purse	Christian Weintraud, Jun.	Offenback, in the Maine, Germany, & 4, King-st., Cheapside
4061	" 24.	A Box for containing Wax or other Matches	Bell and Black	Bow-lane, City.
4062	" 26.	Self-acting Lever for removing Cartridges when fired from Breech-loading Guns and Rifles	Joseph Lang	22, Cockspur-street, Charing-cross.
4063	March 1.	Improved Swing Kettle Stand	Thomas Pettiver	Trinity-street, Islington.

Journal of the Society of Arts.

FRIDAY, MARCH 12, 1858.

COUNCIL.

A Special Meeting of the Council was held on Wednesday last, the 10th inst., to consider the propositions published in last week's *Journal*, in reference to a proposed Exhibition in 1861. The discussion occupied the whole evening, and was adjourned to Wednesday, the 24th inst., when the Council will be specially summoned.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The days for receiving articles intended for exhibition are Thursday the 18th, Friday the 19th, and Saturday the 20th inst., and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, for insertion in the Catalogue, with a wood block (when possible) for illustration, and a reference to any publication in which the invention is described.

All drawings exhibited must be framed.

No charge is made for space, and the Exhibition is free.

EXAMINATIONS, 1858.

The Council have appointed the following gentlemen the Board of Examiners for the present year:—

Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
Mathematics.	
Algebra	Rev. Harvey Goodwin, M.A., Cambridge.
Geometry, Mensuration	Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.
Trigonometry, Conic Sections	William Spottiswoode, Esq., F.R.S.
Physics.	
Navigation and Nautical Astronomy	John Riddle, Esq., F.R.A.S., Head Master of the Nautical Schools, Greenwich.
Statics, Dynamics, Hydrostatics	Rev. A. Bath Power, M.A., Principal of the Diocesan Training School, Norwich.
Practical Mechanics	T. M. Goodeve, Esq., Professor of Natural Philosophy, King's College, London.
Magnetism, Electricity, and Heat	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
Astronomy	Rev. Baden Powell, M.A., F.R.S., Savilian Professor of Geometry in the University of Oxford.
Chemistry	Dr. A. W. Williamson, Professor of Chemistry, University College, London.
Animal Physiology	William Sharpey, Esq., M.D., F.R.S., Examiner in University College, London.
Botany	Arthur Henfrey, Esq., F.R.S., Professor of Botany, King's College, London.
Agriculture	J. C. Morton, Esq.
Political and Social Economy	Charles Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
Descriptive Geography	Wm. Hughes, Esq., F.R.G.S.
Physical Geography	Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea.
English History	E. S. Creasy, Esq., M.A., Professor of History, University College, London.
English Literature	Rev. F. Temple, M.A., Head Master of Rugby School.
Latin and Roman History	F. R. Sandford, Esq., B.A., Assistant Secretary to the Committee of Council on Education.
French	Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.
German	Dr. Bernays, Professor of German, King's College, London.
Freehand Drawing	F. S. Cary, Esq.
Mechanical Drawing	Thomas Bradley, Esq., Professor of Geometrical Drawing, King's College, London, and Master at the Royal Military Academy, Woolwich.

EXAMINATIONS.—LOCAL BOARDS.

The Committee of the London Mechanics' Institution have passed the following resolution:—

"That the Local Board of the London Mechanics' Institution, Southampton-buildings, is prepared to undertake the previous Examination of Candidates from any Society in Union with the Society of Arts not having a Local Board of its own."

ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relative to this subject, has

been prepared at the request of the Committee, by D. Roberton Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society:—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date:—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, Auditor	10	10
T. H. Bastard	5	0
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

FALKIRK SCHOOL OF ARTS.

The following letter has been received from the Falkirk School of Arts:—

Sir,—At a meeting of the Directors of the Falkirk School of Arts, held on February 10, 1858, the following resolutions were unanimously adopted, and were ordered to be transmitted to the Secretary of the Society of Arts, London.

1. The Directors wish to remark, that the controversy which has recently occurred, connected with the system of Examinations in Institutions where class instruction exists, has caused their attention to be directed to the position and objects of the Institution with which they are more immediately connected, and to the relation which it holds, and the advantages which it derives, or might derive, from its connection with the London Society of Arts. The remark made in the circular from the latter, dated December 4, 1857, seems to the Directors of this Institution one of great importance, viz., that "the funds contributed by the Institutions in Union ought to be so expended by the Council of this Society as to afford to all parts of the Union, as far as possible, an equal amount of advantage." In unison with this sentiment the Directors of the Falkirk School of Arts would remark, that the principal object of the Falkirk School of Arts, since its commencement in 1827, has been to furnish to the inhabitants of the town and surrounding district annual courses of lectures on subjects of a literary and scientific character. At first these were, to a considerable extent, of a kind suited to the tastes and wants of mechanics. Gradually, however, it was found that the support given by this class to the Institution was too limited to enable it to exist, and the lecturers employed had to be changed—more of a generally popular element being studied in their selection. With this change the Institution revived, and has for a number of years gone on prosperously. The audience now consists of a fair mixture of the public generally, a considerable proportion being ladies. A syllabus of this year's course of lectures is enclosed, to show the class of lecturers which it is necessary to employ, in order that success may be ensured. A library was also, for many years, connected with the Institution, but experience taught the Directors that this was only a burden to them; for, on the one hand, they could not procure from the members sufficient funds to afford this, on its own account, proper support, and these funds had therefore to be drawn from what was realized from lectures; while, on the other hand, the lectures on this account necessarily became less attractive from the diminished remuneration that could be given to lecturers. In attempting to do two things, therefore, neither was done well. The conviction on this point became so strong, that for many years the library, consisting of six or seven hundred volumes, was locked up without being used, and latterly the whole was presented to a public library in the town, open to the public at a moderate rate of membership.

2. It will be seen, from what has been stated, that the Directors, after the experience they have had, now consider their vocation to consist in furnishing to their townsmen annual courses of miscellaneous lectures. In order

that these shall be successful, they have become aware that two conditions are necessary, viz., very moderate prices of admission, and a preponderance of first-class lecturers. The prices of tickets, for example, are this season 3s. 6d. for adults, and 2s. 6d. for young persons, while the sums paid to lecturers are respectively £4 4s. and £3 10s. per lecture, and £10 for each musical lecture, making an aggregate for the course, exclusive of three gratis lectures, of £60 12s., a sum the Institution could not pay without the contributions of honorary members.

3. From all that the Directors have been able to learn, as well from what they see in their own neighbourhood as from the information they have obtained, and the opinions they have heard expressed by the different lecturers who have visited them, a very large proportion of the flourishing country Institutions in Union with the Society of Arts are in a situation very similar to their own. If such be the case, it must be obvious to the Council of the Society of Arts that this and similar Institutions derive little or no direct advantage from their connection with the Society of Arts, and that with such the keeping up the connection, by the annual payment of £2 2s., must eventually, under these circumstances, become a question for consideration.

4. While such, the Directors candidly state, has hitherto been their experience, they have no wish to withdraw from the Union; but they would respectfully submit to the Council of the Society of Arts, whether it would not be possible to devise some means for lessening the expense of procuring first-class lecturers, a benefit which they feel would apply to every Institution in the country. Whether this could be done they do not presume to say; it is sufficient that they have indicated their position and the difficulties they have to contend with. They may mention, however, what the lecturers themselves have often remarked to them, that if continuous engagements could, by any arrangement, be procured for really first-class lecturers, a much smaller sum than is usually given would remunerate them better than what it is at present necessary to give, especially to those coming from a distance. Whether, also, railway companies could be induced to modify their rates to lecturers on their professional visits, is also, perhaps, a subject that might engage some attention.

In conclusion, the Directors of the Falkirk School of Arts would again beg respectively to state, that their own pretty ample experience convinces them, that Institutions like their own will find, ultimately, that the lecturing department, when well managed, is that which is most attractive, and therefore the most remunerative and the most to be depended on; that it is unfair to this department that the funds to be derived from it should be diverted to other purposes, and that, in effect, the attempt to do so, will generally be found to injure both; and that any efforts of the Society of Arts to aid the Institutions, generally, ought, in the opinion of the Directors of the Institution, to have especial reference to the procuring of first-class lecturers at a moderate rate. With such, the Directors have no fears for the success of their Institution, and without this they are afraid that it would be hazardous to ensure the continuous prosperity of any Institution, based, like their own, on the support of the public generally.

I am, &c.,
GEORGE HAMILTON, M.D.,
Secretary.

The following is the reply of the Council:—

Society of Arts, Adelphi, London,
10th March, 1858.

"Sir,—I am directed by the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce, to acquaint you that the resolutions passed by the Directors of the Falkirk School of Arts, on the 10th February last, have been very carefully considered.

"The Council are always glad to receive, from the Directors of any Institution in Union with the Society of Arts, suggestions for increasing the advantages which the Society can impart to the Institutions; and the Council can neither expect nor desire that any Institution shall remain in the Union without receiving, directly or indirectly, a full equivalent for its annual payment of £2 2s. to the Society's funds.

"It should, however, be borne in mind, that the existence of the Union confers a *prestige* and an increase of strength upon the Institutions.

The very valuable provisions of the "Literary and Scientific Institutions Act, 1854," (17 and 18 Vict., c. 112) would never have been enacted if the Union had not existed. The members of the Institutions in the Union, when absent from their own neighbourhoods, can obtain access to nearly all of the other Institutions which the Union comprises; and, when in London, can attend the discussion meetings and lectures, and visit the exhibitions, of the Society of Arts, on the same terms as the Society's members. The *Journal* is supplied weekly, without charge, to each of the Institutions; they are supplied occasionally with specimens, photographs, and other articles, for temporary exhibition; they can purchase books, maps, and scientific apparatus at considerably reduced prices; they may confer on their members, as well as on their regular students, the advantages of admission to compete in the Society's examinations for certificates and valuable prizes; and they are furnished with arranged catalogues of lecturers, their addresses, subjects, and terms. The Council of the Society of Arts do not at all desire that all the Institutions in the Union shall be managed on the same plan, and promote exactly the same objects. A great diversity of objects and plans exists among them. The Council do not undervalue a well-arranged system of lectures; and, in the first years of the Union, the Council took much pains to assist the Institutes in this direction. The Council endeavoured to get the Institutes to make, or to enable the Society to make for them, combined arrangements with lecturers, with a view to the reduction of their travelling and other expenses, in order that the cost might be less to the Institutes. The Council hoped that such arrangements might be made, with mutual advantage to the Institutes and to the lecturers; but the Institutes could not be got to combine, and to agree, for this object; and the Conference of the Representatives of the Institutions came to the conclusion that nothing could then be done for them by the Society, in the matter of lectures, except to supply them with the arranged catalogues above-mentioned. It should be added, that the information which the Council have received from many quarters has tended to the conclusion that a large number of the Institutions are giving up lectures as unpopular and unfruitful of good results.

The Council, however, are of opinion that lectures, if they can be placed on a good footing, are not to be despised; and, if the representatives of the Falkirk School of Arts will bring this subject before the Conference, in June next, the subject shall have the best consideration which the Council can give to it. Nothing beneficial can be done, without the effective co-operation of a considerable number of Institutes.

Having made these explanations, the Council cannot but express their hope that the Falkirk School of Arts will find itself in a position to take an influential part in the very important educational work which is now extending itself throughout the Union in connexion with the Society's Examinations.

It is generally agreed, among the friends of popular education, that it is of the greatest possible moment to furnish motives and means for the continuance of instruction among the poorer classes, after the children have left their elementary schools. Such means are found not so much in lectures as in evening schools, and

in classes for systematic instruction in Mechanics' Institutions, Athenæums, and Schools of Art; and such motives are found effectual in the periodical Examinations, Certificates, and Prizes, which the Society has introduced. Local Boards, to co-operate with the Society in this respect, are formed, and in course of formation, throughout England. There are five or six in London, and nine or ten in Yorkshire; besides numerous others in other places.

It is hoped that Scotland will not remain behind England in this great popular movement. Falkirk, surrounded by a large mining and grazing population, might, with advantage, be supplied with, and could easily establish and maintain, a good Local Board; and your lectures might then be really exceedingly useful, when preceded and followed by the more precise and extended teaching of systematized classes and evening schools.

I am, &c.,
P. LE NEVE FOSTER,
Secretary.

To Dr. Hamilton, Secretary, Falkirk School of Arts.

FOURTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 10, 1858.

The Fourteenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 10th inst., R. Wigram Crawford, Esq., M.P., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Aston, Capt. Alex. Theophilus, R.A.	Dees, James
	Schofield, Joseph

The Paper read was:—

COTTON: ITS CULTIVATION, MANUFACTURE, AND USES.

BY HENRY ASHWORTH.

Clothing may be deemed coeval with the creation of man, and its necessity has been held to rank second to that of food. From the leaves of the fig tree, the skins of animals, and a variety of other natural products used as clothing, we have arrived at the adoption of the fibrous substances of wool, silk, linen, and cotton, and now we have superseded the contrivances of primitive manufacturing art, have advanced to the completeness and economy of the present period, and have established the superiority of cotton over every other known material, in regard to utility and comfort, as well as cheapness, for clothing.

The origin of the uses of cotton is very remote. Its production over many parts of the earth is spontaneous, and for three thousand years it has been wrought into garments by the people of India. This knowledge was also, at an early period, possessed by the people of Egypt and other eastern countries. In Spain it was known about the tenth century, and eventually it found its way to England. The Genoese were the first to supply this country with the raw material, probably from the Levant, and it is also probable that the Flemish emigrants introduced the requisite skill to use it.

The arts of spinning and weaving appear amongst the earliest inventions of our race. They are mentioned in the Scriptures, in the Homeric poems, and by Herodotus, Strabo, Arrian, Pliny, and other early historians. Yet, strange as it may appear, in past ages we find that no mention is made of any improved process. It would appear to have been reserved to modern times, and to the people of Lancashire, to subvert their rustic contrivances, and to substitute the mechanical inventions of Hargreaves, Arkwright, and Crompton, as the basis of a manufacturing system. And it is from the period of these inventions that the successful career of our cotton manufacture may date its history.

Under the directing skill of our countrymen, the manipulation of cotton has been conducted with singular success in its adaptation to the various requirements of man, whether within the tropics, or in the colder countries of the north—whether for the people of Europe and America, or for the various oriental countries. The civilizing influence has been universally felt to be closely allied with the progress of our manufactures and commerce, extending not only throughout these islands, but throughout the world at large. The material benefits conferred, and their distribution, we may proceed to consider, and let us record the gigantic strides of progress, and the extent to which our manufacture of cotton has now arrived.

This will be seen by reference to the following account of the quantities of raw cotton consumed. Beginning with the year 1701, and proceeding to 1764, the date of the first improvement in spinning, we find an annual import of cotton of from one to two millions of pounds, which was, to a large extent, consumed as candlewicks. Proceeding from the first germ of invention, 1764, to the year 1856, which was the last year of full employment, and we find the following returns:—

Cotton consumed in	1764	3,870,392 lbs.
Quantity of Cotton consumed after Arkwright's Patent had expired, in 1785.	1785	17,992,888
	1790	30,603,451
	1800	51,594,122
	1810	123,701,826
	1820	145,648,617
	1830	255,426,476
	1840	454,990,492
	1850	588,200,000
	1851	648,800,000
	1852	745,000,000
	1853	734,000,000
	1854	780,000,000
	1855	835,000,000
	1856	920,000,000

Following an increase so enormous in the manufacture of cotton, the inquiry will almost necessarily arise, how has it been disposed of? The table relating to the exports of the year 1853, is unusually explicit, showing that, after having retained in this country large supplies for our own use, the excess of our productions has enabled us to meet the demands of about seventy other countries, to an extent, in value, of £32,712,900.

At the commencement of our manufacturing career (1767), the population of Great Britain was 8¼ millions, and now it has reached 21 millions.

It will be admitted that, without the aid of the manufacturing art, it would have been impossible for so enormous an increase of the human family to have been provided with clothing or food.

The table referred to also shows, that not only have we provided these increasing millions of our own countrymen with cheap clothing, but that we have, also, during that year, exported to other parts of the world, as much in value as 15d. per head, if so distributed, for each of the 878,000,000 of inhabitants who constitute the entire population of the earth.

As before stated, the export of cotton manufactures for 1853, was	£32,712,902
The value retained for home use, which amounts to 15s. 5d. per head of population	£21,224,494
Total value of cotton manufacture for 1853	£53,937,396

Taking in like manner 1856, cotton manufactures exported	£38,284,000
The value retained for home use	23,200,000
Total value of cotton manufactured for 1856	£61,484,000
Increase in three years	£7,546,604

From the total value of cotton manufactures produced in 1856, say	£61,484,000
We have to deduct the cost of the raw material	23,958,000
Thus leaving in this country the sum of	£37,426,000

being the trading advantage which has been distributed as profits, wages, rents, cost of fuel, use of machinery, interest of capital, freight, carriage, and for every article of every kind derived from the resources of the nation.

The number of persons employed in the cotton factories of the United Kingdom in 1856, was—

In England and Wales	341,170
,, Scotland	34,698
,, Ireland	3,345
Total	379,213

Every worker is considered to represent three non-workers.

The above are those employed within the factories, and they are only a small proportion of those employed in all the other branches of the cotton manufacture which are not subjected to factory inspection.

Their numbers appear small in comparison with the vast extent of their productive power, affording the most striking evidence of the triumph of mechanical art, and serving also to display the physical advantages which have accrued to the working-class from having the operations of manual labour consigned to the power of the steam-engine.

Those employed in all our woollen, worsted, linen, and silk factories, are 303,284.

The increase of population is generally considered an evidence of the prosperity of a country. This has been enormous, more especially in the principal towns and seats of industry.

Taking the county as a whole, agricultural and manufacturing, the increase has been as follows:—

Population of Lancashire,	1750	297,400
,, ,,	1801	672,565
,, ,,	1851	2,031,236

Thus it appears that, from a period a little before the invention of the spinning process, the population of the county, as a whole, has multiplied itself by seven.

It has been estimated that, within an area of 30 miles round Manchester, the population exceeds that of the like area around St. Paul's. All this mass of people, although not in immediate connexion with the manufacture of cotton, are ministering, in one way or another, to its requirements, in bleaching, dyeing, printing, or otherwise preparing the articles for sale, or in the distribution of them for consumption.

Other departments of trade, which are necessarily connected with the cotton manufacture, are also extensively carried on, such as the manufacture of chemical preparations, engineering, machine making, building, &c., &c.; wholesale and retail dealers of every kind, besides the numberless little trades which exist on thriving industry, in addition to the interests of agriculture and shipping. By way of survey of the advantages thus derived to Lancashire, beyond those of a trading character, let us take an estimate of the social progress of the people—review the succession of rapid changes in the aspect of the country, and the amazing increase which has taken place in the value of landed estates, coal mines, &c., perhaps unparalleled in extent in this or in any other country.

Camden, in his survey of 1607, speaks of Lancashire as lying "beyond the mountains, towards the Western Ocean," and appears to regard it not only as a foreign, but as hardly a civilized, country. It has been in this unpromising locality that manufactures and commerce have found a genial soil, and in the hands of this race of people, so dreaded by the early historian, that the sciences of mechanics and chemistry have been applied to manufacturing industry, with a practical intelligence unrivalled, and previously unknown.

The rivers which obstructed the Norman conqueror in his march through the district of South Lancashire are now employed in propelling machinery in bleaching, dyeing, and printing our fabrics, and are crossed with bridges and viaducts, for our roads and railroads. The morasses and woods of the country have been rendered fertile by cultivation, and no inconsiderable portion of the surface has been converted into large towns and populous villages, or applied to trading purposes, yielding to the proprietors a largely increased rental. Camden also speaks of the existence of several large towns, and mentions "Litherpoole," as the most convenient and usual place for setting sail to Ireland; but there are many towns, such as Ashton, Bolton, Oldham, Salford, &c., &c., now containing from 20,000 to 100,000 inhabitants, which are not even noticed as existing.

At Liverpool, the changes, as measured by the population, are as follows, taking the Census previous to Camden's survey:—

Say	1555	Population was	138
,,	1693	,,	4,851
,,	1760	,,	25,787
,,	1801	,,	77,708
,,	1821	,,	118,972
,,	1831	,,	165,221
,,	1841	,,	223,003
,,	1851	,,	258,346

The above relates to the parish only, but if the adjoining townships or component parts of the town are included, the population will be 376,065, besides about 12,000 seamen. The increase of merchandise and shipping has been equally progressive.

Year.	Vessels.	Tonnage.
1764	1,625	Not stated.
1800	4,746	450,060
1810	6,729	734,391
1820	7,276	805,033
1830	11,214	1,411,964
1840	15,998	2,445,708
1850	20,457	3,536,337
1857	23,032	4,645,362

The increase in the value of property is universal. We will therefore take the county as a whole, including land under cultivation and waste, as well as towns, and referring to the land-tax returns of 1692, the annual value was £97,242. The valuation of 1853 for county rate was £6,913,073, showing an improved value of 7,000 per cent. The hundred of Salford, taken by the same valuation, shews in—

1692 the sum of	£	25,907
1853 ,,	,,	3,051,347

Or an increase of value of 11,700 per cent.

Without selection of individual towns we will take some of those which Camden does not appear to have discovered:—

	Annual Value in 1692.	Annual Value in 1853.
Ashton...............	£1,345	£150,370
Bolton	301	143,030
Oldham	287	119,669
Salford..............	809	159,328
Total...........	£2,742	£572,397

Or an increase of nearly 21,000 per cent.

The most successful case of improved value is the township of Chorlton-upon-Medlock, adjoining to Manchester. In the year 1590 it was sold for £320; in 1644 for £300; in 1794 for £42,914; and in 1853 the annual value for county assessment was £143,151; or, according to the value of the fee simple, the increase is upwards of 50,000 per cent. in little more than two centuries.

During this extraordinary progress in the value of landed property, there have been contiguous estates which have only improved by reason of improved markets for farming produce. In such cases there may have been an absence of roads or of mines, or of native enterprise, or perhaps a disinclination on the part of the owners to allow the resources of the country to be turned to the most profitable account.

The city and suburbs of Manchester now cover a large surface. The amount of increase of population cannot be ascertained with perfect accuracy, but some idea of its extent may be formed from the following data:—

In 1757 the population of the town or township was estimated at	16,000
1788 ,, ,, ,, ...	42,821
1801 Manchester, Salford, and suburbs	109,166
1811 ,, ,, ,, ...	132,099
1821 ,, ,, ,, ...	180,948
1831 ,, ,, ,, ...	261,584
1841 ,, ,, ,, ...	339,734
1851 ,, ,, ,, ...	439,797

The population of Manchester proper has increased fourfold in fifty years, and, commercially speaking, the above may be considered to represent the progress of the city as identified with the interest of cotton.

Those who have visited Manchester will not fail to have observed that the city is not devoid of architectural pretensions, whether in her public buildings or private establishments. It is not, however, in outward display that Manchester will require to be estimated, but in the characteristic enterprise and industry of her people. The possession of these qualities have made her the cherished home of kindred sprits, who have resorted thither from distant parts of our country and from abroad. The estimation of this community in a mercantile as well as social point of view may be ascertained by the fact that 2,000 German subjects, and large numbers from other countries, have made selection of Manchester as the choicest field for mercantile pursuits.

Although the cotton manufacture has been located around Manchester, it has not been in Lancashire alone that the traces of its success are to be found. The adjacent counties of Chester, Derby, and York, have shared largely in its prosperity, as have also the counties of Nottingham and Leicester, and the cotton districts of Scotland and Ireland. The social aspect of Lancashire may not admit of illustration by returns of figures, but may be described, and in a manner which will be equally intelligible.

It may be, and probably will be asked, whether any, and what degree of attention has been given to the moral and intellectual improvement of the operative class during the progress of those mechanical inventions which have imparted to our machines a degree of power almost intellectual.

In the absence of any public provision for education, indications of neglect will doubtless be found in every department of labour, but still there is abundant evidence that the classes engaged in our manufactures are in advance of the general community, not only in intelligence, but in acquired knowlege. The inducement of money wages for children is found to outweigh the desire of instruction amongst the parents. This difficulty has been attempted to be met by a provision of the Factory Law, which has rendered the attendance at school an indispensable condition of employment.

In no other part of the country is there more zeal and devotedness to the work of Sunday school instruction, nor is there any part of the kingdom where the contributions are so large for the support of them. An assemblage of 90,000 Sunday scholars were but too happy to present themselves to the Queen, and her Majesty will not have forgotten the exhilarating effect thus imparted to her visit to the Peel Park of Salford, in the year 1851.

For young persons, or those of more advanced age, there are Mechanics' Institutions, Athenæums, Schools of Art, and other literary and scientific establishments, in all or most of our large towns.

Amongst other manifestations of social changes it has been observed, that the ruder enjoyments of a previous period are fast passing away, and the people are now become more delighted with those pleasures which are refined and intellectual. With a view to meet this unmistakeable tendency of the times, large sums of money have been raised by voluntary contributions, to provide the people with public parks, museums, and libraries, which are freely open to all.

The ninth annual report of the Peel Park Museum and Library furnishes the following information:—That the library has become increased from 7,000 volumes, in 1850, to 20,503 volumes, in 1857; that the daily average of readers, during the last year, has been 377; and the total issues of books, 147,814.

The Museum Committee report that "this rapidly accumulating part of the Institution has been popular to a degree far exceeding their most sanguine expectations;" that "on Whit-week, 81,030 visitors were counted at the doors," and that the daily average has been 3,508.

The collection of paintings, engravings, and models has been so popular, that, from the opening, on the 22nd April, to the closing, on the 17th October, it is estimated that 500,000 visitors have passed through the gallery.

The Committee close their report by a commendation of the orderly demeanour of the visitors, and the absence of any damage or accident to the articles exhibited.

The last annual reports of the Free Libraries and other kindred institutions for last year are not yet before the public, but it is known that the Free Library of Manchester contains 32,314 volumes; that the daily average issue has been 666 volumes, and that one of the most gratifying circumstances has been the increasing interest in the perusal of "Specifications of Patents," by mechanics who are practically concerned in the application of inventive skill to daily labour.

Were this the place and time to allude to the provision made for the religious welfare and for the wants and infirmities of our manufacturing population, it would be easy to advert to the large number of our places of worship recently erected, and to the numerous institutions for charitable purposes which all our manufacturing towns support.

The alacrity of mind generated in the field of manufactures and commerce, in the cotton districts, has not, as has been ungenerously supposed, been entirely absorbed in the pursuit of wealth. The same spirit of activity is apparent in political, scientific, literary, and social life, and it may safely be anticipated that many of the coming events of our social and political condition will be found to bear the impress of thought characteristic of our thinking and laborious classes; nor are proofs wanting, in the houses of our wealthy manufacturers—not to dwell on the recent Art-Treasures Exhibition of Manchester,—which supply confirmatory evidence that the fine arts are ever most intimately associated with commerce.

Passing from the districts of Lancashire to those other parts of the kingdom which have partaken of the beneficial influence of the cotton manufacture, we may turn to Glasgow, as next in importance. Whilst the leading branch of the cotton trade of Lancashire is mainly concerned with the more substantial articles of clothing, that of Glasgow has excelled in fine muslins and in the

art of embroidery. About the year 1790, the weaving of fine muslins, in imitation of the book muslins of India, was introduced into this city, and has increased very rapidly; afterwards, other fancy fabrics of the loom followed in succession, and the dyeing of Turkey red has become a very extensive and important branch of the cotton business. Calico printing has also been extensively cultivated, and the printed shawls of Glasgow are elaborate productions, and are supplied at a cost which is calculated to favour the million as consumers.

The embroidery of muslins, or the "sewed muslin trade," has assumed great importance, and has become extended from the country districts of Scotland to the north of Ireland. It has been stated by Dr. Strang, in a paper which he read in August last, before the statistical section of the British Association, that, in the neighbourhood of Belfast, the sewed muslin embroidery trade of Glasgow furnishes employment for about 200,000 women and girls, and that the richness and beauty of this work may be estimated from the fact, that a handkerchief, the ground of which costs 3s., may be rendered worth £8. The manufacture of cotton sewing thread is another branch of trade, which is extending in Glasgow and Paisley. Engineering, and other concerns of large magnitude, have been established, and the manufacture of chemical preparations, in connexion with the bleaching of cotton-goods, is largely carried on in Glasgow as well as in Lancashire.

Hosiery.

The hosiery branch of the cotton trade of the counties of Derby and Nottingham is most valuable and useful. The domestic part of it is not subjected to inspection as the factories are, therefore the number of persons employed cannot be ascertained with accuracy, but according to an account taken in 1844 there were at that time employed from 50,000 to 60,000 hands, one-half of whom were women and children.

The statistics relating to progress are not easily found, but the extension and improvement of cotton spinning has led to an extension in the manufacture of stockings, from the year 1787 when the consumption of cotton yarn was 1,500,000; to 1812, when the consumption was 3,820,000; and 1857, when it had reached 9,450,000.

The amount of profits and wages annually derived from this department of trade, was computed, in 1844, at the sum of £1,335,000, and since that period the changes have been very great and very favourable.

The price of a pair of cotton stockings may range as high as 10s., or it may descend as low as 1¼d., thus affording, at an easy expense, stockings to the feet of millions of people who never before have enjoyed that comfort.

The larger part of this labour is domestic, though the greatest share of the weight of cotton yarn consumed is in the factories where cheap stockings are made.

Lace Trade.

The machine-wrought cotton lace trade is chiefly carried on in the counties of Nottingham, Leicester, and Derby. The number of persons employed may be computed at from 50,000 to 60,000, of whom the greater part are women and children, and the labour is largely carried on in factories; the rest is domestic or in the finishing warehouses.

The quantity of cotton yarn consumed, in 1857, was 6,050,000 lbs., of the value of £1,400,000, and the return of profits and wages has been estimated at £1,630,000. The total return for machine wrought cotton lace was, in 1857, £3,030,000.

In the earliest account we have of this manufacture, adaptations of the stocking frame were used for the making of lace. A large portion of these machines were superseded soon after the year 1809, by the patent machines of Mr. Heathcoat. At first there arose a violent conspiracy through the ignorance of the workmen, and a great many machines were broken by the mob. The success which has since followed may be appreciated by reference to the following facts:—

Making lace of both kinds of material, *i.e.*, silk and cotton—

In 1815 the number of machines at work was 140
In 1856 ,, ,, 3,500

And the total number of hands employed, 135,000, who are working upon silk and cotton inclusively.

In 1811, the population of Nottingham was 47,000
In 1856 ,, ,, 118,000

By reason of the superiority of these machines, and the reduction in the price of cotton yarn, the cost of a square yard of cotton lace has been reduced to from five pounds to sixpence, or nearly in a ratio of from one pound sterling to one penny.

Samples submitted.

	s.	d.
D. at 6d. per square yard; cost of 1 lb. of yarn...	2	0
Its value as plain net......	8	0
E. at 8d. per square yard; cost of 1 lb. of yarn...	4	0
Its value as plain net......	16	0
F. at 12d. per square yard; cost of 1 lb. of yarn...	7	0
Its value as plain net......	24	0

The above qualities have been sold at 4s. 6d., and 8d. respectively, when the price of yarn was at the lowest point.

A. at 1s. per yard long }
B. at 1s. 6d. ,, } cost of 1 lb. of yarn £2
Its value as finished lace £9

C. at 7s. 6d. per yard long; the cost of one lb. of yarn.............................. £17 to £20
Its value as finished lace ...... £170 to £200

The raw cotton for the above manufactures would cost from 1s. to 4s.; therefore, the profit and labour, use of buildings, machinery, &c., &c., upon 1lb. of cotton, has amounted variously from 7s. at the lowest to £199 16s. 0d. at the highest point of manufacture.

Worsted Manufacture.

Amongst the recent and most important of the advantages derived from cotton, has been its admixture with wool, mohair, alpaca, linen, and silk.

Of these mixed fabrics, the history of its success in the worsted trade of Bradford will be most deserving of our notice.

To begin with the origin of woollen garments, it may be remarked that, following the Roman conquest, our ancestors had begun to form their raiment from the fleece. From that time to the present, one of the leading characteristics of our progress has been luxury in dress. A succession of advances in the textile arts has introduced the wearing of every variety of animal and vegetable substance that could be fabricated by the loom.

About the time of Henry III., the art of weaving woollen stuffs had become established at a place called Worstead, in Norfolk. Afterwards the trade became settled at Norwich, where it grew into a manufacture of leading importance, and for several centuries, continued to flourish there. At length it approached the coal districts of the north, and became the staple trade of Bradford, in Yorkshire.

This manufacture of worsted stuffs served for female garments, especially for winter, and the damask for household drapery, but the wool of which it was composed did not admit of being wrought into light fabrics, such as the progress of national taste required. Hence, about 20 or 25 years ago, the prospects of this trade appeared very gloomy, so much so, that some of the manufacturers were in dread of its utter extinction. This demand for lighter fabrics in wool aroused the energies of the trade, and the

anticipated difficulty was overcome by the opportune discovery of a mode of admixture of a warp of cotton with a weft of worsted, and eventually with mohair, alpaca, or other substances, but principally with worsted, and the successful issue of this union has imparted new life, by the creation of a new branch of industry, in the worsted manufacture, and without inflicting entire extinction upon that which was previously in existence. The desired effect to be produced by this admixture of cotton and worsted has not been found difficult to accomplish in the loom. A warp of cotton is made to form the length of the piece to be woven, and the cotton threads, being much finer and stronger than threads of wool, receive within their meshes the weft of worsted shot across, and which, in many of the cloths, imbed themselves so deeply into the substance of the wool that the cotton portion of the web becomes completely hidden, and thus a fabric is constructed of little more than half the thickness and bulk that would have been presented to the eye if the length as well as the breadth of the piece had been of wool alone.

In this manner the desire of the consumer has been complied with, and, contrary to custom, instead of an increase of price, increased cheapness by the introduction of cotton has kept pace with the growing demands of taste and refinement. In the first instance, the completeness of this success was seriously impeded by the difficulty of dyeing the goods. The usual chemical process for the dyeing of wool did not answer when applied to a piece of cloth, which was composed of two fibrous substances so dissimilar in their nature, one being animal and the other vegetable. After a series of chemical operations more or less intricate, and after many praiseworthy efforts on the part of the dyers, this difficulty was overcome, and in the wide field of raw materials thus opened out there has been accomplished a most wonderful addition to the extent and variety of modern manufactures.

The principal articles of demand are known as mousselines-de-laine, Orleans cloth, Coburgs, Alpaca, mixtures, damasks, &c., &c.

The encomiums of the judges at the Great Exhibition upon the excellence of this manufacture will not be forgotten, and it may be truly said of this novel achievement, that it has introduced an array of female apparel which, for durability, cheapness, and beauty, stands unrivalled. It would be impossible to form any correct estimate of the advantages derived by those of every class, but, beginning with the wool-grower, we find that the introduction of cotton to the extent of half the piece, threatened not only a corresponding diminution in the use of wool, but also to render wool-growing less remunerative. The result has proved exactly the reverse; the attractions of the article manufactured, together with its comparative cheapness, have eventually called for more wool, and with this increase of demand, the price has greatly improved.

	lbs.	d.	£
British wool grown in 1857	143,042,782	at 19	11,322,219
do. do. in 1835	108,000,000	at 13½	6,075,000
Since we have not the return of the price of wool in 1835, we will take the average price of the last 20 years, ranging as it does from 9¼d. upwards, and averaging 13½d.			
Amount of advantage to sheep farmers			5,247,219

From the above account, it is evident that this change in the manufacture has been attended with an unexpected gain to the British wool-grower, by an increase of trade and higher price amounting to 5¼ millions sterling. The same increase of prosperity and, to a larger extent, has been shared by the sheep farmer of Ireland, but the accounts are not clear, in consequence of large quantities of Irish wool having been sold for shipment to France, Belgium, and Germany.

The beneficial results to the mill proprietor, the operative class, and to all other trades, professions, and pursuits, may be estimated by the increase which has taken place in the manufactories now existing, as compared with those in existence before the introduction of cotton. Worsted factories in the years—

	1838.	1856.	Increase.
Number of factories	415	511	96
Horse-power employed	7,166	14,481	7,315
Persons employed	31,606	86,690	55,084

Along with this increase of 55,084 of hands employed, we find also confirmatory evidence of prosperity in the general increase of population.

The population of Bradford in	1831 was	43,527
do. do.	1851 ,,	103,782

Owing to this creation of a new manufacture, our national industry has been greatly extended and improved, the profits derived from agriculture, as well as those of the manufacturers, greatly increased; more employment, higher wages, and, consequently, happier homes have been afforded to the operative classes; and, along with all this, an equivalent amount of comfort to the consumer. An immense enlargement of the town and contiguous parts of Bradford has resulted, and the aspect of the town has been adorned with dwellings and warehouses of an advanced style of architecture. It has now become the home and abode of many wealthy merchants, foreigners as well as natives; and, in all respects, there have been conferred upon the locality mercantile and social advantages of incalculable extent.

Bradford forms a centre of manufacturing industry, surrounded by Halifax, and many other towns and populous villages engaged in the same sort of pursuit, and all equally prosperous. The woollen cloth trade of the other manufacturing towns of Leeds, Dewsbury, Huddersfield, &c., &c., has shared, in like manner, the economy of the cotton warp, but not to the same extent as in the worsted trade of Bradford, although rapidly extending.

Consumers' Question.

The measure of economy as applied to clothing must depend upon the cost of the raw material, and the subsequent cost of its manufacture. For ordinary purposes the prices and attendant expenses may be taken as follows:—

		Expenses of Manufacture.		Cloth per lb.
1lb. of wool for flannel	18d.	19d.	or	3s. 1d.
1lb. do. for coarse cloth	14	4s.	,,	5 2
1lb. of flax for shirting	10	18d.	,,	2 4
1lb. of cotton for shirting	6	6d.	,,	1 0

Hence, not only the raw material of cotton, but the attendant expense of converting the same into cloth, is out of all comparison below that of wool, and only one-third of that of flax. Cotton as a raw material admits of being wrought into garments for the poor at the low sum of 6d. per pound weight, whilst, as before shown, a single pound of cotton worth 4s. can be made to furnish employment and wages to the extent of £200 in articles of decoration for the rich.

The material for a full dress of outer garments, if composed of wool, would cost not less than 30s., whilst the same quantity of material of cotton, and of more durable quality, would be 7s. 6d. to 10s. The labourer's wife may purchase from a draper a neat and good cotton print at 4d. per yard, and allowing 7 yards to the dress, the material would cost only 2s. 4d.

The current of reduction of price of cotton manufactures cannot be traced with accuracy throughout the period of the modern inventions in spinning, but the following cases of comparison are afforded:—

Mr. Arkwright's Prices, extracted from an invoice dated August 12, 1784.

	s. d.	In 1856.
No. 42 cotton yarn was	10 11	11d. per lb.
,, 50 ,, ,,	15 11	12½ ,,

Other articles of cotton yarn—

1786 the price of No. 100 was	...38 0	...	2s. 6d. ,,
1795 ,, ,, 200 ,,	...51 6	...	8 0 ,,

At the same period—

A wedding dress of calico, known to have been purchased at 6s. per yd.	2½d. ,,
At the beginning of this century the price of No. 60 twist was 1s. over 1d. per hank, or 6s.	1s. 3d. ,,

Taking the comparison at a later date :—

	In 1815. s. d.		In 1856. s. d.
Cotton yarn, No. 40 was sold at	2 8	...	0 11
,, ,, 200 ,, ,,	26 0	...	8 0
⅞ calicoes per yard	1 1	...	0 2½
,, ,, printed	1 10	...	0 4¼
½ ell fustians, 4 oz. to the yard	1 10	...	0 6

The cheapness and utility of cotton have commanded for it a preference which is almost universal, not only for decoration and clothing, but for bookbinding, as a substitute for leather, and for other purposes.

The waste of cotton made during the processes of manufacture is wrought into coarse sheets and bed covers, which are sold at prices varying from 6d. to 9d. per lb.

The residue of the waste is used for the manufacture of paper, the cleaner portion being for writing paper, and the sweepings from the floors of factories supply a large proportion of the paper mills of Lancashire with the raw material of the paper which is used for the printing of books and newspapers.

Summary.

We owe it to the genius of Hargreaves, Arkwright, and Crompton, subsequently aided by Watt, and carried into practical operation by the enterprising efforts of other men, that the previously obscure and humble pretensions of cotton have been raised from insignificance and invested with an importance truly national; that along with the progress of this manufacture, our population has increased beyond any previously conceived limits, the bounds of our industrial pursuits have been immensely enlarged, and the means of clothing have been rendered abundant and cheap.

Mines and minerals previously undiscovered have been rendered productive of profit to their owners; agriculture, shipping, and every other pursuit has shared in the general prosperity; indeed, it would be impossible to measure or to display by any detail of quantities, what has been the development of the national and financial progress of the country. Mr. Porter, in his progress of the nation, says, "It is to the spinning jenny and the steam engine that we must look as having been the true moving powers of our fleets and armies, and the chief support also of a long continued agricultural prosperity."

Thus far we have enumerated the advantages derived from cotton manufacture, but let us not overlook the fact that the manufacture of cotton is not now confined within the British dominions. It has become widely extended over other countries, and although we are still holding the supremacy, the aspect of increasing success abroad appears to menace its long continuance here. Fifteen years ago our machinery consumed two-thirds of the cotton raised, and now it is only one-half.

The following account shows the quantity of raw cotton consumed in the chief manufacturing countries in the year 1856 :—

	lbs.
Great Britain	920,000,000
Russia, Germany, Holland, and Belgium	256,000,000
France	211,000,000
Spain	48,000,000
Countries bordering on the Adriatic ...	39,000,000
United States	265,000,000
Sundries, Mediterranean, &c.	56,000,000
	1795,000,000

It is not the presence of foreign competition, even of the existing formidable extent, that would of itself be deemed sufficient to throw a shade over the future prospects of the British manufacturer. There is a sustaining reliance in the fact, that even now it is only about three-quarters of a century since the operation of spinning all over the world was done by the aid of one spindle.

The position of pre-eminence we now occupy has been attained by our energetic predecessors, who had emerged from pastoral life, and by ourselves their successors. It will not be attributed to those of our day, that the originality of our intellectual power in manufacturing skill is being exhausted; on the contrary, there is no lack of fertility of genius. It is, therefore, not unreasonable to look forward hopefully to an extension of that industry, if our political and other institutions are so regulated that they do not fail in their duty to commerce.

The soundness or unsoundness of our manufacturing prosperity has become an object of study, not to say of solicitude. That position which we now exult to look upon, either is, or ought to be, of a permanent character, and it would indeed be reprehensible in us if we were to shut our eyes to any appearance of danger lying before us. All the elements of continued prosperity are in our possession, save one only, and that is a most material exception, namely, the command of a regular and adequate supply of raw cotton. This constitutes the structural weakness, the "feet of clay" of our otherwise gigantic commercial power.

Cotton Supplies.

In the early part of the present century, our supplies of raw cotton were received from upwards of thirty different parts of the world—countries from most of which we now receive none whatever; and, as a consequence, we are now dependent upon the United States for seven-ninths of our supply.

As a commercial question, it is a matter of indifference to the manufacturer or the consumer in what part of the world cotton may be grown; but in a national and economic point of view, the question of an adequate extent of growth is one of the utmost importance. It is desirable, if not absolutely necessary, that our supplies should be drawn, not from one source alone, but from a variety of sources, not only to secure greater regularity of supply, but as a provision against the inconvenience arising from scarcity and dearness, and possibly against other and still more serious disasters.

The cotton of the United States is admirably suited to all our wants. We have no indisposition to deal with the American people. We know that it is the desire, and not beyond the power, humanly speaking, of the planters of America to uphold the continuance of those supplies of which we have need, provided they could have an adequate command of labour, but this they have not, and, therefore, the extent of their growth is necessarily limited to the extent of negro labour on their plantations, as well as to the casualties attendant upon crops of every kind. It is known also, that the cotton-lands of the United States are limited in their extent, ranging across that country from 33 to 34½ degrees of north latitude, and that the cultivation of them is tending ultimately to their exhaustion.

The cotton-plant is exposed not only to the ordinary vicissitudes of good or bad seasons, but to disasters frequently arising from storms, and from the attacks of worms and caterpillars; nor ought we to overlook the uncertainties to be apprehended from a continued reliance upon slave labour, or from an atmospheric epidemic, such as the vine disease or the potato rot. These are considerations of serious moment, as affecting our reliance either upon America or upon any one single country.

A failure of slight extent has an immediate effect upon the price of cotton. An advance of one penny per pound

upon our present consumption of cotton, amounts to four millions sterling a-year; and the increase of price last year over that of ordinary years was about 3d. per lb., being at the rate of twelve millions of pecuniary outgoing from the British manufacturer to the cotton planter, which could not, except to a small extent, be recovered in the subsequent price upon the manufactured articles sold to the consumer. Recent experience has not been wanting of an apprehended dearth of cotton, and it is to be hoped that the warning thus exhibited may become of some avail hereafter in producing forethought for future supplies.

For several years past, the annually-increasing demand for articles made of cotton has stimulated the manufacture, and has thus gradually reduced the stock of raw cotton which is usually lying upon the market for sale. In the month of September last, this reduction had proceeded so far as to raise an alarm, and it was seriously contemplated that the stock of cotton would be entirely exhausted before the close of the year. This disaster was, for the time, provided against by the occurrence of mutiny in India and money-panic in America, which, together, closed two of our best markets for manufactures, and caused a seriously-diminished rate of consumption by the stoppage of mills; and, at the present time, the stock of American cotton in Liverpool is only equal to the consumption of three weeks, and the entire stock of all kinds is only equal to a consumption of four weeks.

The entire failure of a cotton crop, should it ever occur, would utterly destroy, and perhaps for ever, all the manufacturing prosperity we possess. Or, should the growth in any one year be only one million instead of three millions of bales, the manufacturing and trading classes would find themselves involved in losses which, in many cases, would amount to irretrievable ruin—millions of our countrymen would become deprived of employment and food—and, as a consequence, the misfortune would involve this country in a series of calamities, politically, socially, and commercially, such as cannot be contemplated without anxiety and dismay. Evidence of the existence of such an emergency makes a loud appeal to the nation. Already the subject has received attention from the manufacturers, and they have formed themselves into a Cotton Supply Association, for the purpose of diffusing information and encouraging the cultivation of cotton, and of communicating with those persons who might thus become interested in the prosecution of any new project for the culture of cotton.

They have ascertained that there are a great number of localities where cotton may be grown under favourable auspices in respect to soil and climate, but in almost every country there exist obstacles, local or political, which would render it inexpedient to raise the necessary capital for investment. The tenure of land would, in most places, be found insecure, and the pursuit would be subject to institutions which are of an unstable and shifting character.

One instance may be related as interesting and encouraging. By the instrumentality of an energetic and philanthropic individual, Mr. Thomas Clegg, of Manchester, there have been received from Western Africa, during the last year, 795 bales of cotton, besides which, there were 340 bales lost by a fire, making 1135 bales which had been prepared for market by the chiefs and other natives of that country, acting under the advice of our excellent consul, Mr. Campbell, of Lagos. This success, however encouraging in itself, will appear of little significance in a commercial point of view, seeing, that if this production was measured against the rate of our consumption, it would serve us just one hour. The fact of itself deserves our warmest appreciation, and indicates the power of the free negro to minister to his own comfort and to the world's progress; it is confirmatory, also, of the opinion of Dr. Livingstone, that, "Africa is the very territory for cotton."

India: its Government and Capabilities.

In the East Indies we have a country to which hereafter we must look for large supplies of cotton, silk, and other valuable products.

For a long series of years the Manchester Chamber of Commerce, as well as many public-spirited individuals, in and out of parliament, have aroused the attention of the country to the dangers of our continued reliance upon the United States for so large a proportion of our cotton, and have not failed to insist upon the capabilities of India. The urgency of this subject they have unceasingly pressed upon the legislature, the government of India, and the public, and the present crisis in the affairs of India affords the opportunity of procuring the entire removal of every obstacle.

The extent and fertility of the lands of India show a capability of growth for cotton which cannot be questioned. Agricultural labour is to be had in great plenty, and at wages seldom exceeding one penny a day. The climate is free from those damaging frosts to which the cotton plant of America is subjected in the planting and the picking seasons. The plant, when supplied with moisture, yields most abundantly, and of excellent quality. Hence any quantity of cotton may be raised that we may require. It is known that India produced largely from the earliest ages, before a single bale had been grown in the United States, and with all the increase of territory in India, by annexations and otherwise, how is it that it has lagged so far behind?

Our Indian empire is considered to be equal in extent to the surface of all Europe, yet, whilst our most urgent wants of cotton could be supplied by the growth of a smaller surface than that of an English county, that which they have sent during the last 35 years has varied from 1-12th to 1-6th, averaging only about 1-8th, of the consumption of Great Britain. This deficiency will not be attributed to the inability of the country, or the lethargic indifference of the people to supply our wants. It will, therefore, be necessary to consider whether the policy of the government of India has been favourable or otherwise to production and progress. So far as can be gathered of the policy of the government of India, the effect has not been to encourage European enterprise and capital employed in the cultivation of the soil. Referring to the evidence submitted to Mr. Bright's Committee of 1848, it was stated that it was the policy of the government of India to frustrate rather than to encourage the efforts of the English merchants in any attempt to improve and fertilise the soil, and in a dispatch which was read before that Committee Europeans were expressly forbidden to purchase land in fee simple. Mr. Mangles, the Chairman of the Court of Directors, stated, in explanation of their dealings, that "Any Europeans may purchase land in any part of the Company's settled possessions; but of course Europeans can only purchase what any native has to sell. He cannot purchase the fee simple in the sense in which we in England speak of the fee simple. He cannot buy what a man has not to sell. The state throughout India has a lien upon the revenue of the land, which it cannot and ought not to part with, either in favour of the cultivator or any other party."

The government is virtually both sovereign and landowner. The improved security, so called, of tenure, is a lease of 30 years, which they will not allow to be transferred, and the land so held is liable to seizure, and the lease to forfeiture, at the discretion of a collector, and no judicial appeal is allowed if a sale or transfer be attempted without express permission.

According to the statement of Mr. Marriott, the proportion of land revenue collected ranges from one-third to one-half of the gross produce of the soil, and Mr. Mangles makes it even more than this. From the small amount of the salaries of the native collectors, and from the temptations of dishonesty, it has been attributed to them that they are not trustworthy. The Committee inquired of Mr. Mangles, "If the natives were well paid,

do you think they would be trustworthy?" His answer was very significant, "More trustworthy, certainly. The experiment has never been tried, but it ought to be tried." Mr. Mangles also made the astounding admission, "That while the company had, during the preceding 14 years, derived a revenue from India of £300,000,000, the entire sum spent during that same period in roads, irrigation, and other public works, amounted only to the sum of £1,400,000."

Mr. Henry St. George Tucker, formerly chief financial officer under the government of India, and then, in 1846, deputy chairman of the East India Company, says, "Will industry be called into action when the demand of the tax gatherer keeps pace with the produce? Will capital accumulate where there is no security for property; no law but that which is administered under the auspices of a revenue officer? Will opulent consumers be found where no capital is allowed to accumulate? And can any country advance and become prosperous where land has no saleable value; where there is no motive for laying out capital in improvement, and where no order of human beings is to be found between the Government and the labouring peasant?" "Certainly not."

Those who have described the condition of the people of India, uniformly concur in remarking upon the onward progress of destitution. Mr. Shore says, "Throughout the country we found flourishing villages and innumerable houses, inhabited by men who lived in the style of gentlemen, keeping up their establishments of servants, horses, elephants, and equipages. These are now falling into decay, while the owners or their descendants are dwelling in mud huts, with little more than the mere necessaries of life."

Mr. Tucker, in a letter to Sir Robert Grant, describes the country as "verging to the lowest ebb of pauperism; that a large portion of the public revenue has been paid out of the capital of the country, small as that capital is in itself, consisting of jewels and ornaments of the precious metals, cattle and household utensils; in addition to this lamentable evidence of poverty is another of equal force to be seen in all parts of the country, in the numerous individuals of the above class wandering about for the employment of hirelings, which they are glad to obtain even for the most scanty pittance."

Mr. Chapman says, "that the agricultural population are so totally ruined and thrown into the hands of the money-lender, that they have, roughly speaking, to begin the world afresh every ten or twelve years."

Under this extreme poverty the cultivator, ground down betwixt the upper and the nether millstones of the tax-gatherer and the usurer, finds himself raising a crop of less than 100 lbs. of cotton to the acre, whilst the same culture under proper irrigation would have yielded him 400 lbs., and of a quality worth thrice the price per pound. The indigenous cotton grown without irrigation is dry, short, and dirty, and notwithstanding all the disadvantages under which the cultivator labours, the cost of production has been put down variously as ranging from 1½d. to 2½d. per lb.

At these prices the Indian could beat and undersell the American cultivator, but the affair of market competition does not rest upon growth alone; there is another and hitherto an insuperable difficulty and occasion of expense which has altogether deprived the cultivator in India of his advantage in first costs.

In the absence of roads, railways, canal or river navigation, his cotton has to be conveyed sometimes a sixty days' journey from the interior to the place of shipment, on the backs of bullocks, and after having been wasted in the jungles, it has, or may have, to pass through the hands of two or three sets of dealers, and when it has been adulterated with dirt, loaded with expense, and the first cost become doubled, it is then shipped to Liverpool to be sold in competition with the clean cotton of the United States.

We have already indicated the propriety and necessity of immediate changes in India, more particularly with reference to the security of tenure to be given to the land, the provision of irrigation of improved means of conveyance, and of other essential facilities which rightfully devolve upon landlords.

How shall we approach this subject? In dealing with ordinary practical questions we are accustomed to have reference to the results of experience, and the nearest case of example will be found in the United States of America, the country with which we have been engaged in the friendly strife of cultivating cotton, and have so ingloriously been defeated.

Those who had to do with the Institutions of the United States in regard to the future wants and prosperity of their fellow citizens in that country, had before them the world's experience of conducting a government, and amongst the rest they could not fail to have reference to the policy which this country had adopted with relation to India.

Did they follow our example, or, rather, did they not shun it?

In one respect they were unable to follow it, and, therefore, the example was needless, They had not, as we had in India, a cultivated country and an abundant population, whose resources and whose industry they could exhaust.

Their starting point was upon the hunting ground of the Red Indian, whom they had to expel, and upon that they have founded the most prosperous empire in the world. They knew they had a source of wealth in the development of a fertile soil, provided they could attract labour and capital into the country by emigration.

And how did they go about the promotion of their object?

The various States struck out their territorial boundaries, framed their own laws for regulating the construction and the upholding of roads, bridges, &c., not forgetting the education of their youth, and they made large appropriations of lands to cover the expenses. They took an enlarged view in every sense. They sold the cultivator his land out and out, and did not leave him to toil upon the cotton lands pestered with tax collectors and unprovided with means of conveyance. When the proprietors of steam ships sought the navigation of their rivers, they did not set aside the application as the government of India did that of Mr. Bourne, allowing him to wait nine years, till mutiny arose, before they would give him an answer; on the contrary, they acceded at once, and may now proudly boast that their mighty rivers are crowded with steamers, probably exceeding in number and in magnitude all the river steamers of Europe, conveying their productions and their merchandise in untold extent for shipment and distribution to all parts of the world.

The cost of conveyance of a bale of 400 to 500 lbs. of cotton a distance of 1,000 miles upon the Mississippi river has been as low as one dollar, and ranges from that sum to 1½ dollar, or 6s. 3d., and it is therefore in commodious and cheap conveyance, and not in the cost of growth, that the present advantage of America over India as a cotton growing country is to be accounted for.

The general prosperity of the United States may be determined by the fact, that the demand for public lands has been large and constantly increasing; that the receipts for land sales and the import dues at the custom-house have supplied the revenues of the government, without the aid of a single tax-collector; and such has been the prosperous issue of their care and forethought for the cultivator, that from one crop alone, that of cotton, the cultivators now raise a larger pecuniary amount, from year to year, than all the Government revenues of India, opium included. It may be alleged that the two cases are very different, and so they are, the disadvantage being on the side of America, in having to commence upon a country without people. It may also be supposed, that land sales in India cannot be made as in

America, because the people are poor. The same supposition existed with regard to Ireland. When the potato famine had desolated that country, and the Encumbered Estates Act was passed, to enable the capitalists of England, it was supposed, to buy up Ireland, it was, at that time, little expected that capitalists would be found in Ireland, as it has since proved that there were, who would become purchasers of the principal part of the land offered for sale. This may, or may not, be the case in India—the opportunity has not been afforded. We know that, over and over again, applications have been made by capitalists for permission to invest their money in the fee-simple of the soil, and that these applications have been uniformly resisted. We know that there are many wealthy natives; that a large portion of the Indian debt has been loaned by these people; that many millions a-year of payments in silver are sent from this country to India, amounting in 27 years to £150,000,000 sterling, and it is believed that a large portion of this coin is remaining in the country. These afford indications of a course which may deserve to be considered.

There is a duty of a very serious and solemn character devolving upon this country, in relation to the future of India; and there is also a duty, no less weighty, in regard to our own country, and to the difficulties which are already indicated as menacing the commerce of the kingdom.

In approaching that duty, let us thoughtfully consider the responsibility attaching to the exalted position we have assumed, in having possessed ourselves of India, and in having dispossessed the people of their native rulers.

Conclusion.

As an existing race, we make boast of our historic origin—we trace our proceedings through eventful ages, through periods of darkness and gloom mingled with alternate gleams of light and progress, apparently insensible that what we call antiquity is comparatively of yesterday; and that in regard to passing time, the earliest Britons stand only amongst those links of the chain which connects the past with the present. There is a charm of vitality in these reminiscences which the poet Richards has embodied in the following lines, illustrative of the character and power of the Ancient Britons, which we, their descendants appear to have inherited:—

"Rude as the wilds around his sylvan home,
In savage grandeur, see the Briton roam!
Bare were his limbs, and strung with toil and cold,
By untamed nature cast in giant mould:
* * * * * *
Such was the race who drank the light of day,
When lost in western waves Britannia lay.
* * * * * *
In these rough days of Albion, 'midst her snows,
Hardy and bold, immortal Freedom rose.
Now walks the land, with olive chaplets crowned,
Exalting worth and beaming safety round;
With secret joy, and conscious pride, admires
The patriot spirit which herself inspires;
Sees barren wastes with unknown fruitage bloom;
Sees labour bending patient o'er the loom;
Sees science rove through academic bowers,
And peopled cities lift their spiry towers—
Trade swells her sails, wherever ocean rolls,
Glows at the line, and freezes at the poles.
* * * * * *
That mind which hid in savage breasts of yore,
Lay, like Golconda's gems, a useless ore,
Now greatly dares sublimest aims to scan—
Enriches science and ennobles man;
Unveils the semblance which its God bestowed,
And draws more near the fount from whence it flowed."

In the above picture of the poet our country has been truthfully described, and at the present hour the same spirit is inspiring us to further efforts, and leading us to vaunt ourselves upon the rapidity and extent of recent progress, pointing to the cultivation of arts, science, literature, and philosophy, and to our having attained a manufacturing and mercantile pre-eminence, and a command of wealth and power undreamt-of by our forefathers.

Let us not forget how suddenly and unexpectedly we have become possessed of the ingenuity which has led the way to all our modern progress, and that, along with the possession of property and of intelligence, there are also duties to be observed as well as rights to be enjoyed. These discoveries are rapid advances, are chiefly of the last half-century.

Shall we still advance?

It is evident that the permanence of our national power must mainly depend upon the continuance of that manufacturing supremacy which we now hold, but which has been shown to be threatened with danger.

It must be well known that our manufacturing industry is not sustained upon British products alone,—that its first element, raw material in every branch is chiefly supplied from abroad. The returns have shown that that manufacture which, more than any other, contributes to our national commerce is cotton; an article which is indispensable, to sustain the existence of that large fabric of property and industry which is essentially its own, and almost in an equal degree to that its kindred manufacture—wool.

This alarming necessity for raw cotton, we know that our fellow subjects in India would be but too happy to supply, if facilities were afforded them to do it. Those who are best acquainted with the resources of India, affirm their belief that if we would now proceed to establish a proper tenure for land, and provide the needful arrangements for the complete and profitable occupation of the soil by means of roads, railways, canal and river navigation, with irrigation for the crops, all of which they surely ought to possess, the people of India would become a flourishing people, gratefully attached to their rulers, and would become far larger consumers of our manufactures; and thus the prosperity of both countries would be secured.

We must ever bear in mind that it is not for India alone that we are concerned, but for the consolidation of our commerce, and the advancement and security of that national greatness which we hold in our possession. Hence, efforts require to be made to an extent correspondent with the magnitude of the evils impending over us and requiring to be averted. In short, an obligation of the most sacred character demands that we should at length do justice to that vast dependency. Measuring our duty by no higher standard than that of material interest, it is but too obvious that, should we continue to withhold from India that which is rightfully her due, our own industry will stagnate, our commerce decline, and the end of so disastrous a policy will be our own impoverishment, humiliation, and national dishonour. On the other hand, should we adopt the ennobling principles of justice, and in that spirit administer the functions of our rule, we might then look forward with confidence to the existence of a prosperous empire, and to the grateful emotions of a contented people, whose industry we had released from thraldom, and whose laws we had founded in equity and placed within the reach of all.

DISCUSSION.

Colonel Sykes, M.P., F.R.S., lamented the ignorance which prevailed in this country relative to India. If people would but go to India and see its state for themselves, he was persuaded the fictions which were put before them, from time to time, would produce no impression. He had marked down at least a dozen passages in Mr. Ashworth's paper which he could refute by facts; but the lateness of the hour would only permit him to take up one or two of them, in order to show how utterly unfounded were the assertions that had been made. Mr. Ashworth had stated that the fee-simple of land was not to be obtained by purchase in India. What was meant by fee-simple? Was there in existence in the present day in any part of the world a fee-simple of

land that did not pay some tax? Had not land in this country always been subject to a land-tax, which, in the present day, even amounted to £1,200,000? There was no land in this or in any other civilised country exempt from the payment of rates, county roads, &c.? Land might be obtained in India if it were made worth the while of the owner to sell it. He would read to the meeting some of the Government rules under which land could be held by those who could persuade the owners to sell it—not in fee-simple, as Mr. Ashworth had called it, that was, free from taxation, a state of things which had no real existence—but under the terms which he would read to them :—

"Throughout the greater part of India, land is already private property, and cannot therefore be disposed of at the pleasure of the Government. Europeans may, however, under Act IV., of 1837, "acquire and hold in perpetuity, or for any term of years, property in land, or in any emoluments issuing out of land," in any part of British India. It is only in districts like Goruckpore and the Deyrah Dhoon, where large tracts of waste land exist to which no individuals have any claim, that the Government have it in their power to make over the property in the land to applicants desirous of cultivating it. The terms adopted for grants in these districts were, a lease for forty years, under which one-fourth of the land was to be rent free for the whole term and the remainder for three years, after which the twentieth part of the rent assigned was to be paid, rising annually in twentieths, until at the end of the twenty-third year, the maximum rent of twelve annas (1s. 6d.) per acre would become due, and the land, subject to that payment, would be the *absolute property of the grantee*. Conditions were inserted in the lease to provide for the land being brought into cultivation according to stipulated annual proportions, on failure in which the portion of the grant found to be uncultivated, reverted to Government. In the districts of Kumaon and Gurwhal, there are immense tracts of land suitable for tea cultivation, which are at the disposal of Government. These lands will be granted to persons possessing sufficient means and capital in lots of from 200 to 2,000 acres, one-fourth to be free from assessment in perpetuity, and the remainder for four years, after which a rent of one anna (1½d.) per acre will be charged, rising annually by the same sum, until in the twentieth year, when the maximum rate of one rupee (2s.) per acre will be reached, after which the *proprietary right in the grant vests in the grantee*, who, in whatever manner he may cultivate the land, will never be called on to pay more than the average rate on grain crop lands in the same locality. Provisions are to be inserted in the lease to secure the land being cultivated with tea plants, which are supplied gratuitously by Government to the extent of their means."

For four years no rent at all was paid, and it was only at the end of the 20th year that the maximum rent became due, one-fourth being free of rent for ever, and the rest being at from 1s. 6d. to 2s. per acre for land which produced sugar, indigo, and oil seed worth £20 per acre; and, moreover, the land, subject only to that payment, would be the absolute property of the grantee. Therefore, notwithstanding the assertion of Mr. Ashworth to the contrary, there were means of obtaining property in land in India. In the district of Kumaon and Gurwhal, there were, as was stated in the rules which he had read, immense tracts of land suitable for, the cultivation of tea, and this was being carried on with satisfactory results, producing teas which rivalled, if they did not excel, those of China itself. In fact, the people there paid more for that tea than was paid for such an article in this country. The conditions inserted to provide for the proper cultivation of the land could hardly be complained of. The official rules which he had quoted were now in existence, and had been made as far back as the year 1837, and these rules applied to the whole of India—wherever there was waste land. About one-third of the land in India was waste. The great outcry was that India had not sent cotton for the home market—that it did not produce a regular and reliable supply of that article. Did the cotton manufacturers expect that people were to cultivate cotton in India and lay it up in store to meet the demand of the Manchester manufacturers just at the time when American cotton chanced to rule a farthing a pound dearer? Was that the expectation of the intelligent classes in this country? Was it rational to suppose that it could be done, and was it right to call upon any class of people to do it? Ought the government of India to interfere with any person's estate so as to compel him to cultivate any particular product in preference to any other? Had they any more right to do that in India than the Government of this country would have had to call upon the landed proprietors of England, to cultivate potatoes for the benefit of the Irish during the late famine? He contended they had no more right to interfere in the one case than in the other. Now, let them see what had been done in India, as regarded the cultivation and export of cotton in particular. The Government of India, for the last 30 years, had been engaged in prosecuting experiments with the cotton-plant. It had tried every variety of soil, and had had seeds brought from the United States, from Pernambuco, Egypt, and other parts of Africa. As much as £100,000 had been expended by the Government in these experiments, without the slightest advantage whatever to itself. It had been found that those cotton seeds except at Dharwar would not succeed in India; the indigenous plant was that which would flourish best there. Nevertheless, the stimulus applied by these cotton experiments had produced some striking results with regard to that article. The export of cotton from India to England, in the years 1834-5, amounted to 38 million lbs. In the years 1855-6, the latest date to which the customs returns were made up, the quantity exported was about 170,000,000 lbs. Thus the increase in the export of cotton from India to England in 20 years was more than 340 per cent. Did that show a want of stimulus or a lack of disposition on the part of the people of India to cultivate cotton when it was worth their while to do it; but at the same time, was it reasonable to expect that they should cultivate cotton when they could get a far larger return from the cultivation of sugar, indigo, or oil seeds? Then, again, with reference to the export of cotton from India to all parts of the world. The quantity exported in the years 1834-5 to all parts of the world was 98,000,000 lbs., and in 1855-6 it was 237,000,000 lbs., or an increase of 140 per cent. in the export of cotton to all parts of the world, whilst the exports to England alone increased in that period 340 per cent. Thus far as regarded the article of cotton. Whose fault was it if the manufacturers in England did not get the quantity of cotton that they wanted? He supposed people did not usually sit down and expect the good things they wished for to be dropped into their laps. If they wanted them they must go after them, or employ others to do so for them. Why had not the cotton manufacturers done what he had been for the last 20 years endeavouring, in print and verbally, to persuade them to do? Why had they not gone themselves to India, or sent their agents? Why did they not do as the indigo manufacturers had done? Those gentlemen went to Bengal, and either acquired landed estates, or made arrangements with the owners of such for the cultivation of indigo, which they manufactured in their own establishments in India and exported to this country. Others had done the same to obtain sugar and oil seeds. Why did they call upon government to do that which they ought to do for themselves? If they had done what he advised, they would probably have been able to obtain any quantity of cotton they required. There was a fertile soil, a fine climate, a willing people, low wages, and they had nothing to do but to make such arrangements as had been made by the indigo manufacturers. This had been done in Madras and Candeish, and no doubt it was the same in other parts, almost the whole of the factories being owned by Europeans. Therefore, he contended, the fault was with the cotton manufacturers of England and not with the government of India. To go into the condition of the people of India by way of reply to the assertions contained in the paper would occupy more time than the meeting would be in-

clined to accord him, but he would only touch on an important point. He had before him the whole of the facts relating to the condition of the labouring population in the north-west provinces, including the Bombay Presidency, comparing it with that of the working classes in this country in relation to wages. In India the wages would be about 6s. per month, whilst in this country he would take them at 10s. per week. The result with reference to taxation was that whilst the pressure in India was 6·94, in England it was 8·04. Those were facts—not suppositions—which anybody could determine for himself. He could enter into statements with reference to the condition of the farming population in India and the other subjects adverted to by Mr. Ashworth, but it would occupy too much time to do so on the present occasion. In the North Western provinces, taking the total area, the average rent of land at the present moment was 1s. 7½d. per acre for land capable of producing sugar, indigo, oil-seeds, and also cotton. The rent for the cultivated land in those provinces did not exceed 2s. 4½d. per acre, and the highest assessment was 3s. 0½d. to 4s. per acre. It was objected that there were no roads to convey the produce to the seaports for exportation. How then was it that 378 000,000 lbs. of cotton had found their way to the coast for shipment if there were no roads? There must have been a profit to the owners, or they would not have sent the cotton to the coast. The whole country was a sound, hard, dry road for eight months of the year, but during the monsoons, of course there could be no roads at all. Then as to irrigation; during the last five years the Government had expended two and a half millions sterling annually on irrigation, roads, and public works in India, according to a return to the House of Commons. It was his desire that the facts regarding India should be looked into, and he advised the gentlemen who were continually calling upon Hercules to help them in procuring cotton, to put their own shoulders to the wheel, and the cotton waggon would go along at a railway pace. *

Sir ERSKINE PERRY, M.P., said, his hon. and gallant friend had come to the rescue of the East India Company at an untimely moment. It had been said by the present Chancellor of the Exchequer, not long since, that the East India Directors, of whom the gallant Colonel was one, were corpses, but the warmth just shown by his hon. and gallant friend went far to contradict that assertion. Colonel Sykes had, on this occassion, pursued the course too often adopted by the advocates of the East Indian government in charging those who disputed their policy with gross ignorance and fallacies of every description. He had also distracted the attention of the meeting from the real object before them. They were not there to try the East India Company, or to go back into the history of the policy which, for a century past, they had pursued. The question was could they obtain any further supplies of cotton from India or not? He would tender his best thanks to the gentleman who had read this paper, and also to the men of Manchester and the North, who had kept this subject so steadily before the public. They were considering in another place what the future form of Government in India was to be, and all our best statesmen were applying their attention to that great subject; but he thought none of the details of such a measure were to be compared in importance with that which had been brought before them in the paper of that evening; for it was one on which the future prosperity of this country, and also of India, mainly depended; it might be that the men of Manchester were self-interested in this question—but it belonged to the development of commerce, that its true interests coincided with the progress and happiness of mankind at large. The gallant Colonel, with much warmth, had challenged contradiction of the facts he had brought forward, and he (Sir Erskine Perry) accepted the challenge. Colonel Sykes had made bold assertions before a meeting in which there were persons present who were as well acquainted with India as himself, and perhaps better. He would take the most important of his statements, and prove it to be entirely incorrect. Colonel Sykes read some rules to prove that the acquisition of the proprietory-right in land in India was open to all, Europeans as well as natives, and therefore that the outcry against the short-sighted policy of the Court of Directors was mere declamation. Upon that he entirely joined issue with him. Throughout India generally, no capitalist could invest money in land, for the simple reason that land had no saleable value. The rack-rent assessment of Government left no surplus arising out of the soil beyond the means of subsistence. The gallant Colonel had referred to the Englishmen who had grants of land in the neighbourhood of Goruckpore, but he (Sir Erskine Perry) had been there, and had rarely see such desolation in any part of India. In fact, it was notorious that most of the grantees were insolvent. What did that say then for the terms which the great landlord—the East India Company—offered to its tenants? But, instead of looking to remote jungle districts, such as Kumaon and Goruckpore, to which the gallant Colonel had referred them, he (Sir Erskine Perry) would turn to the cotton-growing districts of India, and show them what was the actual produce of the land, and the amount of rent paid for that land. In these districts an acre of good black soil would produce only 60lbs. of clean cotton, and the value of it, including the seed that might remain for sale, was only 11s. What was the rent or assessment of the Government upon that? It was very nearly 4s.—it was 3s. 8½d., and to this must be added the cost of cultivation.

* In further elucidation of this subject, the following extract from a notice in the *Times* of a work by the late Dr. J. Forbes Royle, F.R.S., entitled "Review of the Measures which have been adopted in India for the Improved Culture of Cotton," is inserted at the request of Col. Sykes:—"Whatever, therefore, may be the result of judicious culture in special localities, the prospects of obtaining a large supply of American cotton of Indian growth are very doubtful. But it is certain that native Indian cotton might be obtained of a quality and at a price to compete with a large proportion of the American cotton. Though short in staple, and not easily spun by machines suited to American cotton, the natives contrive to spin it into the finest yarns. In strength, durability, and other good qualities it is well adapted for at least one-half of the manufactures in this country—that is, for all yarns under No. 20. Indian cotton of this quality could always be sold with profit in Liverpool at 3¾d. a pound. The cost of production and of carriage is not the hindrance to a large and regular supply. But the uncertainty of price in the English market, determined by that of American cotton, prevents the steady increase of Indian culture and commerce. When the difference between the two cottons is ¾d. to 1d. a pound the spinners of No. 20 yarn will give the larger sum for American cotton, on account of the waste from the inferior condition of the Indian cotton. It is to the improvement of the quality and state of the Indian cotton that attention ought to be first of all directed. Since it can now be sold for a profit in Liverpool at 3¾d. a-pound, there is a wide margin for improving the quality so as to secure a demand in the market. It must be admitted that little can be done at present towards improving culture. This can only be effected by the slow influence of European or American overseers superintending the ryots, and by the stimulus of a higher price offered for a better article. But there are other causes which depress the value of Indian cotton in the market. It is carelessly collected, carelessly cleaned, carelessly housed, and carelessly packed. The middlemen who buy it from the ryots fraudulently adulterate it to such a degree that one-fourth of the fair price is the usual deduction of a purchaser for estimated impurities. The ryots, naturally indolent, prefer the tolerably certain return for inferior and dirty cotton to the trouble and expense involved in having a cleaner cotton ready for the agents when they come round to purchase."

Col. Sykes said the assessment was 3s. 9d., but the value of the produce was greater than had been stated.

Sir Erskine Perry said he took the value of the produce from the testimony of Mr. Shaw, an intelligent civilian in the Company's service, who, for many years superintended the cotton cultivation in the South Mahratta country, and he had stated that the produce of an acre of land was 60 lbs. of clean cotton. There was also, the report of Dr. Wight, which had just been laid before Parliament, and this gave precisely the same results. That being the produce of the land, the assessment being 3s. 8½d., and the cost of production from 4s. to 5s., all that was left to the cultivator as profit was about 2s. 10d. per acre per annum. He would ask whether, with such an assessment upon the land, any capitalist would invest in it? The real fact was, that the land had not a saleable value. The next argument used by Col. Sykes was that cotton was not a profitable article to cultivate, and that as the land could be better employed in other productions, it was no part of the duty of the government to dictate to the owners what crops they should grow. That was a point never contended for by anyone. Free trade in land and production was what he advocated. The other argument, which had been frequently employed in the House of Commons—but a more absurd one was never put forth—was, that if the manufacturers of Manchester wanted cotton, they should go to India and produce it. The manufacturers were to turn cotton farmers—in fact, to convert their spindles into ploughs. Was not that argument upon the face of it absurd? Allusion had been made to the indigo planters. But they, in fact, were manufacturers. The plant was grown by the cultivator, and the blue was subsequently manufactured by the Europeans.

Col. Sykes—That was done with cotton by the Europeans in Candeish and Guzerat.

Sir Erskine Perry did not believe that, at the present time, there was a single European cultivator of the soil in Candeish. He had travelled through that district from beginning to end. A finer cotton country could not be found. It was covered with the remains of old irrigation works, but was now a perfect jungle, and quite neglected. He would make, however, a concession. He did not believe British capital would be immediately effectual in producing more cotton from the soil. Cotton was not like indigo in Bengal, or coffee in Ceylon—the direct production of skill and of capital applied to the land. It was a produce requiring simple agricultural labour, and ordinarily fertile soil. It was not therefore likely that capitalists would invest in land which would yield them a profit of less than 3s. per acre. In this country ordinary wheat land in the hands of a capitalist produced from 4 to 5 quarters of corn per acre, at 60s. per quarter. No British capitalist therefore would go half round the world to cultivate land at a profit of 3s. per acre. It might be said that capital employed in irrigation would increase the crops. That was true. But if they applied capital and skill in this way, the capitalist—whether European or native—would raise more valuable products than cotton. They would grow oil-seeds, tobacco, and sugar; and if a Manchester house sent out agents to India to grow cotton, and those agents reported that they could make 30 per cent. by growing sugar, in the place of 5 per cent. by growing cotton, their employers would, of course, say, "grow the more productive crop." He, therefore, did not believe that British capital and skill would increase the immediate production of cotton in India; but if wise and generous principles of government were applied to that country; if waste and fertile lands were sold in perpetuity, without an onerous land assessment, which destroyed all saleable value, then he thought British capitalists would invest in it, and raise the valuable products he had spoken of. But the same laws that would enable the European capitalist to do that, would operate as an incentive also on the native capitalist, and profits which did not attract a European would be amply sufficient for a native. The possession of land was so highly regarded in England, that a lower amount of interest was accepted than in any other kinds of investment, and the love of land was just as deeply implanted in the breasts of the natives of India, who would invest in it if sold in fee simple—a thing not now known in that country, but which he hoped would shortly be introduced there. They would then see a great increase in the supply of cotton, grown by native capitalists and worked by native cultivators; and, under those just and equal laws which he trusted would be accorded to all our fellow subjects, of whatever colour or creed, those great and useful results which Mr. Ashworth had touched upon would be brought about, upon which the prosperity of this country and of India so mainly depended.

Dr. Watts could not withhold his humble testimony to the extreme value of the paper read by Mr. Ashworth. The point which he wished more particularly to notice, was one which had not been touched upon by Mr. Ashworth. The great stride in the cotton manufactures took place upon the removal of the duty upon cotton. Since the removal of that duty the increase in the trade of cotton-printing had been from 500 to 600 per cent. Dr. Watts proceeded to remark that it was somewhat anomalous that, whilst the tax had been removed from cotton, yet that the refuse of that material, when made up into paper, was subject to a very heavy excise duty. It was remarkable that for some of the Continental markets it was requisite to wind the sewing-cotton upon millboard, so that whilst the cotton itself was free from duty, the material on which it was wound was taxed.

Mr. J. B. Smith, M.P., said he had listened with some surprise to the speech of Col. Sykes, as coming from one of the governors of India, and, therefore, possessing some interest and importance. The House of Commons had recently decided that the government of the East India Company should terminate. He had given his vote in favour of bringing in this bill and the speech he had heard that evening quite confirmed him in the conviction that he had given a sound vote on that subject. The East India Company had, for more than a century, had possession of a country which, from its earliest antiquity, had been celebrated for its riches. The riches of India were proverbial. The late Sir Charles Napier, in his own strong language, had said of India that, "What the Koh-i-noor was among diamonds, India was among nations." It possessed all the climates of the world, and a capability of yielding every kind of produce. But, notwithstanding we were possessed of this extraordinarily rich country, we exported more of our manufactures to a few thousands in Australia, than to the whole 200,000,000 of the population of India. This fact alone ought to be decisive with regard to the Government of that country. The gallant colonel had referred to the extraordinary increase in the exports, and assumed some credit to the Indian Government for that increase; but this had taken place in spite of the Government. From the very commencement the Government had endeavoured to prevent the settlement of Europeans in India, and, up to the year 1833, it was a misdemeanour for an Englishman to be found on the British territories of India. He would ask, what would have been the difference at this day if Englishmen had had the same right of proceeding to India and holding land there, that they had in our other British colonies? Instead of having only between 300 and 400 British subjects settled in the interior of India, there would probably have been 400,000 to 500,000 Englishmen settled there. Would the present state of things in India have existed if such had been the case? We had taught the Indian people nothing but the use of arms, and those they had turned against us. Colonel Sykes had told them an extraordinary story about the tenure of land in India. He (Mr. Smith) had been a member of the Committee of the House of Commons appointed to inquire into the growth of cotton in India.

Evidence was there given, showing that the mode of levying the assessments was, that when the cotton was ready to be picked, a surveyor went round and assessed the amount to be paid by the owner. If it was a good crop he had a proportionately large sum to pay; if a bad crop the amount was less, and the poor grower was left with just enough to keep body and soul together till the next crop. The committee reported that in the presidency of Bombay the ryots were in the most abject condition. Lord Harris then stated that in Madras there were 5,000 000 farmers, and that not ten of that number owned £1,000. With regard to the condition of the people in Bengal, Col. Sykes had spoken of this state of things as having existed a long time ago. He would read to them a short extract from the *Friend of India*, in 1851. Mr. Smith read an extract from the paper quoted, which stated that the general food of the farmers was nothing more than boiled rice, with sometimes a little salt, and numbers could not procure that, but, as a substitute for salt, ate the dried leaves of the plantain. Others could afford a few drops of oil with their rice, and he who possessed a dwelling with mud walls was considered a wealthy man.

Col. Sykes—Those were under the Zemindars.

Mr. Smith would take the whole Presidency of Madras, which was under the government of the Company. The account from which he quoted went on to state that, pressed down as the ryots were by the load of taxation, they were too poor to purchase the Company's salt as an accompaniment to their miserable food of boiled rice or vegetables—the latter frequently consisting of the wild herbs of the country. They were unable to supply themselves with clothes beyond a piece of coarse cotton fabric, worth 2s., once in twelve months. This state of things was the grand secret of the smallness of our exports to India The people had not the means of purchasing our productions: and Sir Thomas Munro, one of the highest authorities on Indian affairs, had said that the only reason why we did not export a large amount of our productions to India was because the people were unable to purchase them; and he added that if the land-tax were altered, roads made, and irrigation carried out, the condition of the people would be improved, and the amount of our manufactures consumed would be surprising. Now, as to cotton. Mr. Ashworth had stated a fact which might not have struck them at the time—namely, that a bale of cotton was brought down the Mississippi, a disof 1,000 miles, at the expense of about one-eighth of a penny per lb. That was about three parts out of a hundred of its value. The cotton in India had to be transported some 200 or 400 miles on the backs of bullocks, in a country where there were no roads, and it occupied 60 or 70 days to bring the produce to the markets, and sometimes as much as three months, if overtaken by the rains. The consequence was the expense, instead of being three parts out of the hundred, was fifty parts out of the hundred; and, therefore, we could never have a trade with India in cotton, except the price of cotton was so high as to repay the enormous expense of the carriage If the price of cotton fell one half—say from 6d. to 3d. per lb. the American cotton grower still paid one-eighth of a penny per lb. expense, whilst to the Indian grower nothing would be left. The consequence was he ceased to cultivate, and did not return to the cultivation till the price rose so as to enable him to pay this high charge for carriage. Some time since he (Mr. Smith) had read a paper* before the Society, pointing out the obstructions that existed to the production of cotton in India. Col. Sykes had said why did not the Manchester people go out and grow it for themselves? Englishmen would not go into a country where there were no roads and no laws to protect them. Mr. Mangles, the present Chairman of the East India Company, in his evidence before the Cotton Committee, acknowledged that it was the duty of the Government to make roads and promote irrigation, and likewise to afford protection to life and property—none of which they had done; and it was vain to call upon Englishmen to waste their capital in India until they had those facilities. The gallant Colonel had talked about indigo, but there was this difference between indigo and cotton —that cotton was a raw article, worth from 3d. to 6d. per lb.—the cost of bringing it to market being half its value—whilst indigo was a manufactured article which sold at from half-a-crown to six shillings per lb. and it was very little consequence whether the carriage was three half-pence or 6d. per lb. He believed cotton could be grown cheaper in India than in any other country, but this could not be done without irrigation and roads to bring it to the market. Let them look at the Presidency of Madras: in the whole of that province not a quarter of the land was cultivated; three-fourths was lying idle, and yet it was full of population. They had heard of the proposition to send coolies to the West India Islands for the purposes of labour. Why not keep them to cultivate the richest land in the world at home? The reason was that the land wanted irrigation. In the eastern parts of Madras there were remains of works of irrigation, which, reckoning the difference of money in this country and in India, were supposed to have cost as much as the whole of the railways in England. Therein lay the secret of the riches of India which they had heard. It was the irrigation which made the soil productive. It was the same with Nineveh, Babylon, and Ancient Egypt. once teeming with population and wealth—but now wastes; and from the same causes the land of India remained a waste for want of irrigation. Until the East India Company did their duty in the way of works of irrigation and roads be had little hopes of improvement in the condition of the people of India. But he had this hope when the government passed out of the hands of its present rulers, as he hoped it would, and if placed upon the same footing as our other English colonies, India would be equally prosperous with them. There was a colony near to India—the little colony of Ceylon. Would they credit the fact that there were more roads in that little island than in all India. That was a colony under British government, and here it had not neglected its duty.

Mr. J. A Rose alluded, in warm terms, to the foundation of the British Indian empire by the middle ranks; and, seeing the pitch of eminence to which, he said, that empire had been raised, he, for one, would be sorry to see the government wrested from the hands of the middle classes and transferred to those of the aristocracy, who, he considered, had already a sufficient share in the government of the country. Speaking of our relations with the United States in connection with the supply of cotton, Mr. Rose remarked that those in America most anxious for peace were the cotton growers of the Southern States, and contended that if we made ourselves independent of America for our supply of cotton, the great incentive to the maintenance of peace would be destroyed.

Mr. Theobald complained of a want of candour on the part of Col. Sykes, in the course he had adopted in citing the official rules, which he had applied wrongfully, as he (Mr. Theobald) submitted, to the tenure of land, as they were accustomed to regard it. The act of 1837, he contended, applied to the removal from foreigners, whether European or otherwise, of certain disabilities which previously existed, and not to the tenure of land. The great question to be considered was, whether lands in India could be acquired on such terms as would make it profitable for Europeans to hold them. The provinces from which they must practically look for the supplies of cotton were those of Madras and Bombay, and he submitted that those were the districts with which Col. Sykes ought to have dealt in disputing the propositions of Mr. Ashworth. The rules which

* See *Journal*, Vol. V., p. 374.

Col. Sykes had quoted applied to Upper India, 700 or 800 miles from the nearest ports from which cotton could be shipped for Europe, and to a part of India from which there was a very remote probability of even getting any cotton at all; but Col. Sykes had forborne to tell them what was the state of things in those parts from which they must look for the sole supplies of that commodity. It had been asserted that leases for a limited term could be obtained on terms favourable to those who took them. What Europeans wanted was a perpetual tenure, and he understood Col. Sykes to quote those rules as showing that they could obtain land in perpetuity. He (Mr. Theobold) said, as respected the proofs given, Col. Sykes had failed to show that such was the case. The sense in which he had applied the act of 1837 was not a correct one. What was the character of the tenure in Bombay? The servant of the collector, at a salary of 8s. per month, ascertained the state of the crops, and the value of the land, and made his assessment from year to year accordingly; and they knew from the report of the Madras Torture Commissioners what the nature of the collection was in that presidency. There were numerous modes of torture employed in order to collect the revenues. Would torture be resorted to if the payment were not of the most extortionate and oppressive character? And they knew, from the general description given, that the population was reduced to a state of extreme poverty; and,—whatever gentlemen connected with the East Indian Government might say,—this could be traced to the amount that was drawn from the people in the shape of land revenue. They not only wanted cotton, but cotton of a quality that could be used by the Manchester manufacturers. How could they hope for improvement in the cultivation with the population in the condition that had been so truthfully described by preceding speakers? There were other causes which produced this state of things in India, foremost amongst which was the want of a just administration of the law, and of due protection to those who did enter the country; and he saw no prospect of improvement in those particulars so long as the officials of the Government were protected in their mal-practices by the Court of Directors at home.

Colonel Sykes begged to state, in reply to Mr. Theobald, that the rules he had quoted with reference to land-tenure, applied equally to the whole of India, from Cape Comorin to the Himalaya mountains.

Mr. Otway would allude to the dictum of the gallant colonel, as to the general ignorance in this country upon Indian matters, if it were only to offer him the consolation that the English people were in rapid course of enlightenment on that subject. He called upon the present meeting to accept, with the least possible confidence, the statement with reference to Indian matters that fell from a director of the East India Company, for, in his opinion, these gentlemen were not very accurate in their figures, and made general assertions which had frequently been proved wrong. With regard to the assessment, as far as his own knowledge went, he believed it was taken upon the value of the crops from year to year. Colonel Sykes had stated that, during the last five years, two and a-half millions had been annually expended by the Government in public works in India. This was not a fair view of the case. He (Mr. Otway) ventured to say that not half a million had been expended upon really useful public works.

Col. Sykes said this expenditure was shown by returns to the House of Commons.

Mr. Otway said it was true that immense sums had been expended for barracks and military works, but were those works of a character to benefit India, or calculated to develope the resources of the country. Mr. Ashworth had pointed out the defects in the present Indian administration; and he (Mr. Otway) could not congratulate the gallant colonel on the advocacy of the gentleman (Mr. Rose) who had boasted of the conquest of the empire from Burmah to Scinde. There was much sad truth in that statement, intended as complimentary to the East India Company. It was too true that they had turned their attention to works of aggression; to building up an empire for purposes not connected with the honour and true glory of the country. They had neglected the development of its industrial resources, and that wealth which made a people truly rich and happy. Let them desist from these disastrous aggressions, and let them turn their attention, above all things, to the cultivation of cotton, and they would then confer benefits, such as the wildest dreamer never conceived, both upon India and this country.

Dr. Riddell wished to make a few observations, with regard to the capabilities of growing cotton in India, so as successfully to compete with the American agriculturist in the English market; for the wants of the manufacturers were such that, if from any causes at present unforeseen, the supply from America should fail, or be insufficient, a greater calamity to the nation could hardly be contemplated. He thought that it was to India we must look with the greatest confidence for meeting any deficiency, and for a continued supply of this product, whether it were from acclimatized, foreign, or indigenous seed, samples of which were lying on the table, which might be considered fair specimens of of what had been grown in the Deccan without the assistance of irrigation—a point, he thought, of the utmost importance, for he felt certain that, if it was ever intended to raise this article to any extent on our Indian soil, we must not look with too much confidence to being able to bring irrigation to the aid of its increase and improvement, knowing, as he did, from the length of his sojourn in that country, that, where irrigation was at hand, either from the proximity to rivers, streams, or tanks, it would be found that a more valuable product could be raised, in nine cases out of ten, than the one in question. They had been told by Col. Sykes that the American cotton could only be grown in the Dharwar districts. He (Dr. Riddell) had placed upon the table cotton grown by himself in the vicinity of Hyderabad, in the Deccan, and if those samples were placed before the best judges in Manchester, he felt confident they would be pronounced nearly as good as any that could be sent from America. If they could grow clean cotton in India like that before them, why should they go to America for it. He thought, if the resources of India were attended to, cotton like that now exhibited might be produced very extensively, and the wants of the Manchester people met. He had also placed on the table some samples of indigenous cotton, which, in Manchester, was generally declared to be 25 per cent less in value than American cotton, because it was dirty, adulterated, and unfit for immediate use. This often arose from such causes as the following: When the cotton was collected and brought to the villages, it was placed in heaps, and wood ashes were strewn in circles over it, to prevent persons stealing it without its being discovered. Other kinds of adulteration occurred, sometimes accidentally, but oftener intentionally. Besides this, he had often observed, that when the cotton was ripe for picking, the cultivator could not do so, because the assessor or collector was not forthcoming, perhaps for several days, to make his valuation. The cotton thus became loose, fell from the pods to the ground, and had to be picked up from the dirt which adhered to it, and contributed to the deterioration of the commodity for the market. It was generally picked from the bush by women and children, who took in their hands the external covering of the dry pod, which became a mass of dirt, and necessarily adhered to the wool, and was mixed with it. These were only a few of the causes from which the complaints against the indigenous cotton had arisen.

The Chairman said, at the late hour to which the proceedings had extended, he should probably best con-

sult the wishes of the meeting by not entering into the question in the way he could otherwise have wished to have done. Having passed a considerable portion of his life in India, and having taken a deep interest in its affairs, he had hoped to be able to take part in this discussion, but he had no doubt he should best consult their wishes by passing at once to the pleasing duty he had to perform, of proposing that the thanks of the meeting be given to Mr. Ashworth for the very interesting and very instructive paper he had submitted to them that evening.

The vote of thanks was then passed.

Mr. Henry Ashworth, in rising to respond to the vote of thanks, was desirous in the first instance to offer a few remarks upon the discussion. He said that Colonel Sykes had called in question the accuracy of some of his statements relating to India. In the remarks he had made upon the government of India, he had not put forward any statement that was not found in the most reliable publications relating to that country, and in those he had quoted he had purposely made selection of Mr. Mangles, the Chairman of the Directors, and Mr. Tucker, the Vice-Chairman. Therefore, if there was any error in the statements he had made, they had originated with the colleagues and co-directors of Colonel Sykes at the India Board. However, after the plain and straightforward manner in which Colonel Sykes's own statements had that evening been met and contradicted, there was no further need for remark upon them. Col. Sykes had endeavoured to convince the audience that the government of India had established a code of regulations relating to the holding of property, which he chose to consider unexceptionable, and he (Mr. Ashworth) was therefore desirous to submit to Col. Sykes one or two inquiries which would be held to indicate their success. First he would inquire what number of European settlers had availed themselves of this very unexceptionable land tenure in India during the 20 years which had elapsed since the terms had become so easy. [A call was raised for Col. Sykes, but it was found that he had left the meeting.] Mr. Ashworth remarked that he would have preferred the answer of Col. Sykes, but as he was not present, he (Mr. Ashworth) must answer his own question. According to statements publicly made, and referred to by the hon. member for Stockport, the entire number of European settlers in all India, not in the service of the Company, and not in the cities, was betwixt 300 and 400. Another question which he would have put to the gallant Colonel was, the amount and value of exports annually sent from India. Every one must be aware that one of the best practical tests of the prosperity of a country was its exports. How much of their produce could the people of India spare for other countries after having provided for their own wants? He was not at that moment familiar with the exact return of Indian exports, but he judged that they might be about 12 millions sterling. Did this indicate prosperity? He had that evening shown them that in the cotton manufactures there were 380,000 of our population identified with exports of 38 millions, whilst the 200 millions of population of India had been unable to export but little more than one-third of that amount. It was, therefore, evident that the attractions of improved tenure had failed to receive confidence, and that judging of the people by the paltry amount of their imports and exports, they must be in a most miserable condition. Mr. Ashworth then thanked the meeting for the patient attention they had given him, and for the kind manner in which they had appreciated the little effort he had made.

The Paper was illustrated by numerous specimens of Cotton in the raw and manufactured state.

The Secretary announced that on Wednesday evening next, the 17th inst., a Paper by Monsieur F. R. de la Trehonnais, "On the Past and Present of French Agriculture," would be read.

The following letter has been received by the Secretary since the meeting:—

Sir,—As I had not the opportunity of taking part in the discussion last night, I beg to call the attention of members to the measures now in progress for carrying out that important principle of the English colonisation of India. Mr. J. B. Smith well pointed out that European energy and enterprise, by means of immigration to healthy climates, was the great and effective step to the promotion of the growth of cotton, and of the development of the resources of India. In prosecution of this I beg leave to observe that the Chairman (Mr. R. W. Crawford) has undertaken to bring before the House of Commons the railway question, and on Tuesday next Mr. W. Ewart moves a Committee of Inquiry on colonisation. The subject of India has been so prominently taken up by this Society, that I trust these motions will meet the support of the parliamentary and other members.—I am, &c., HYDE CLARKE.

Northern Bengal Railway, 42, Basinghall-street,
March 11.

BUCKS AND BERKS LECTURERS' ASSOCIATION.

The Bucks and Berks Lecturers' Association was founded in 1854. A paper was read by the Rev. E. Hale, at a meeting of clergymen, in the neighbourhood of Windsor, giving an account of the Hants and Wilts Adult Education Society then recently established. It was determined the attempt should be made in the districts accessible from Windsor, and the Association started with the object "of promoting, especially in country villages, lectures, libraries, and reading-rooms."

The country Institutes find generally a great difficulty in procuring lecturers. Country lecturers, particularly gratuitous ones, are usually unsupplied with diagrams. Village reading-rooms, before they can be fairly started, require—

1. A small sum to provide the room with fixtures, &c.
2. A supply of lectures.
3. A supply of books for the exclusive use of the reading-room. These wants can be met by co-operation in almost any neighbourhood.

The Bucks and Berks Lecturers' Association first collected, as its name implies, a body of men willing to lecture. It then admitted as members, annual subscribers, and donors of £3 and upwards. Its funds were expended in making grants to village reading-rooms, in purchasing diagrams, &c., and in providing circulating libraries of 50 vols. each for the use of the Institutes or reading-rooms in Union.

The Association, considering the vast importance of night schools and evening classes in Institute, offers prizes for their encouragement. The following circular gives the scheme of prizes for this year:—

Bucks and Berks Lecturers' Association, 1857 and 1858.—Patron: H.R.H. the Prince Consort. Notice to classes of Institutes and Reading Rooms, and to Night Schools in union with the Association.

1. A gratuity of £2 is offered to the Institute or Reading Room, whose members at any time during the winter have numbered 50, have the greatest number of pupils for classes, (in proportion to the number of members.)

2. A gratuity of £2 for the best kept register of an evening class, or night school.

N.B. The register sent in must be the one actually in use.

3. A present of books to the value of £1 to the pupil who has been absent from his class the fewest times in a course of not less than 4 months. In case of equality the greatest gross number of attendances to be taken.

N.B Applications for these to be made not later than the 31st of March, 1858. A form of application will be forwarded.

The Association proposes to hold a central Examination, to be open to all members of the above Institutes, Reading-rooms, or Night-schools, in the month of April, 1858, and to give the following prizes:—

1. A present of books to the value of £2 to the member of an Institute, Reading-room, or Adult Class, who shall pass the best general Examination in the following subjects:—Arithmetic, (including Vulgar and Decimal Fractions, and the Rule of Three,) Euclid to the end of Prop. 12, Book I., Geography of the British Isles, History, (the leading facts and dates of the reign of George III.), Writing from Dictation, English Grammar, and Composition.

2. A present of books to the value of £1 to the next best.

3. A prize of £1 for the best Original Architectural Drawing done in a class, accompanied by a certificate from the teacher, of his belief that the design is original.

4. A present of books to the value of £1 for the best abstract or account of a Lecture, or course of Lectures, delivered during the season of 1857-58 in the Institute or Reading-room.

5. A present of books to the value of £1 for the best Original Essay on "The opportunities given to all classes in England for rising to eminence, illustrated by examples."

N.B.—For 3, 4, and 5, the papers sent in must be marked only with the initials of the candidate, but must be accompanied by an envelope containing on the outside the initials, in the inside the name and address of the candidates. The envelopes with the names of the unsuccessful candidates will be destroyed unopened.

6. A present of books to the value of £1 to the scholar of a night school whose writing shall show the greatest improvement during the winter.

The improvement to be judged of by copy-books selected by the manager of the school. There must not be more than one candidate from each class.

7. A present of books to the value of £1 to the scholar of a night school who shall pass the best examination in arithmetic —(first four rules, simple and compound reduction, rule of three, and vulgar fractions.)

8. A present of books to the value of £1 to the best reader among scholars of night schools.

Not more than one to be selected from each class.

N.B. All drawings, papers, and names of the candidates must be sent in to the secretary on or before the 31st of March, 1858, accompanied by a testimonial, signed by the secretary or manager of the institute or school, of general good conduct. The list of examiners and adjudicators will be forwarded hereafter with the date of examination.

E. HALE, *Hon. Sec.*

Institutes are admitted into Union with the Bucks and Berks Association on the payment of two guineas annually; this entitles them to six lectures.

Village reading-rooms, schools, and class-rooms, are taken into Union on the application of a member of the Association. Some 30 institutes, reading-rooms, and schools are now in Union with the Association. By still further extending its operations, and by the appointment of Local Secretaries, who will make known local wants and peculiarities, the Association trusts to carry out still more adequately than at present its original objects.

The Association is in Union with the Society of Arts, and hopes, through the Society's plan of Local Boards of Examiners, to find great aid in its educational work.

The Association is under the patronage of H.R.H. the Prince Consort, who has most warmly encouraged it, having presented it with £50 worth of books, and placed the reading-rooms and evening classes of his farm labourers in union with it.

The Association is also deeply indebted for valuable advice to the Hon. and Rev. S. Best, of the Hants and Wilts Education Society, and to James Hole, Esq., of the Yorkshire Union of Mechanics' Institutes.

The management of the Association is vested in a Committee. The Hon. Secretaries are the Rev. E. Hale, Eton College, and the Rev. T. H. Tooke, Upton-park, Slough.

HERBERT'S FLOATING BEACONS.

The following has been received from the editors of the *Mechanics' Magazine*:—

Gentlemen,—I find in the *Journal of the Society of Arts*, of March 5, the report of a paper read before the Society by Mr. Findlay, on English Lighthouses. Speaking of floating beacons, he says that a Mr. George Herbert has answered the conditions required for a floating light, which are, that it should keep upright, and be free from any violent oscillation. This is done, he goes on to say, by mooring the beacons, "which are of a circular plan, from their *centre of gravity*, which is so arranged as to be nearly or quite on the line of floatation." "Such buoys were brought into use by the Trinity Board in 1854, and perfectly fulfilled the condition proposed."

On turning to the *Mechanics' Magazine* for Nov. 24, 1855, (No. 1685), I find an account of a paper read by Mr. Herbert, on the construction of buoys, beacons, &c., in which he says that, with a view of obtaining a stationary floating body, which should have a tendency to ride easily, and to retain its perpendicularity, "a wrought-iron pear-shaped buoy was constructed, of a circular form in plan, and terminating above in an apex, so distributing the weight as that the centre of gravity should be situated a little below the centre of the plane of floatation, and the bottom was made concave and raised up internally, so as to form a cone, to the internal apex of which the mooring chain was attached."

The article goes on to say that "this quality of retaining its vertical position arose from the force of the tide or wave being simultaneously exerted upon one side of the exterior of the buoy, and on the opposite side of the interior cone; the forces so nearly balancing each other as to retain the floating body in an almost perpendicular position." Now, Sir, I do not doubt that buoys constructed in this way would float nearly upright, but I cannot believe that they would do so for the reason assigned above; nor can I think it necessary that the chain should be attached at the centre of gravity. The simple reason why they would retain their perpendicularity I conceive to be that the resultant force of the water against their sides, caused by a tideway or other current, would act through the point of attachment of the chain, not because the buoy was of a circular form in plan, but because it was *accidentally* a spherical surface below the water, as shown by the drawings, and the chain was attached at the centre of that sphere. And, so far as the *equilibrium* was concerned, the centre of gravity may have been anywhere in the vertical. For the sake of *stability*, however, it should be *below* the point of attachment, if possible. You seem to have pointed out the secret of success in this matter in your number for September 12, 1857,* containing an engrav-

* AN IMPROVED FLOATING BUOY OR BEACON.

At page 485 of our 63rd volume, we published a description of an iron floating buoy or beacon, designed so as to ride easily, and remain perpendicular, or nearly so, in rough water. The essential feature of the improved buoy consisted of a conical hole in the centre, into which the chain used for mooring it rose, being made fast near the centre of gravity of the vessel. M. Trajano de Carvalho, a gentleman belonging to the Naval Architectural Department of the Imperial Brazilian Navy, having heard that this buoy was found in practice somewhat defective, has designed an improved buoy, with the same objects as in the former case, and has favoured us with a sketch of the same. M. Carvalho's buoy is represented in section in the annexed engraving.* It is spherical in form at the lower part, and it will be seen that the aperture in the bottom is dispensed with, the mooring chains being attached to a link at the bottom of a pair of rods, the upper extremities of which turn on pins or bolts. These pins or bolts are fitted at the height of the centre of the sphere of which the bottom of the vessel forms a part, and pass (for the sake of strength) into a cross beam, which, at the same

* The mast or pole of the beacon is considerably shortened in the engraving, to save our space.

ing of a buoy invented by M. Carvalho, which you describe as being spherical in form at the lower part, the mooring chains being attached to a link fitted at the height of the centre of the sphere, and the ballast so disposed as to cause the centre of gravity to fall below the centre of form. The buoy invented by this gentleman would not be liable to injury from the rub of the mooring chain, as Mr. Herbert's always must be.

Trusting that you will use your scientific influence to have proper persons appointed to conduct any experiment which may be made with reference to this very important matter, so that a good idea may not be lost through its having fallen into feeble hands,

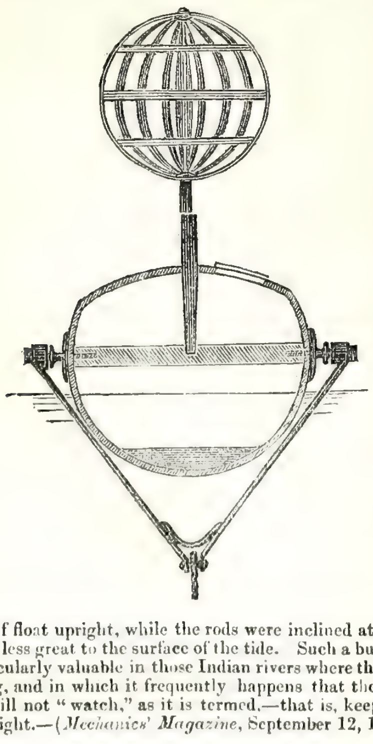
I am, Gentlemen, your obedient servant,

N. B.

March 6, 1858.

[The above letter of our correspondent, relating to the paper which appears on a former page of this number, directs attention to a very important point, and we feel it our duty to respond to the appeal made in its last paragraph. If official experiments are to be made with the improved beacons and lights, let there be no misconception as to the true principle of their construction. It appears to us unquestionable that our correspondent is right, and that Messrs. Findlay and Herbert are wrong. No scientific reason whatever can be assigned for the proposition which they put forward, viz., that a vessel, circular in plan, and moored at or near its centre of gravity, shall maintain perpendicularity in a stream or tideway; and Mr. Herbert's notion, that the action of the current upon the interior of the cone would tend to this result, is manifestly mistaken; for the very circumstance of the buoy being upright will effectually prevent any such action taking place. At the meeting of the Society of Arts, Mr. Findlay mentioned the fact that an experimental beacon, made on Mr. Herbert's principle, had been found, in rough weather, to oscillate through an angle of 10 deg.—about two-fifths of the angle described by an ordinary beacon. Nothing is more likely than that this amount of oscillation arose in great measure from neglect of the true principle to be observed, which, as "N. B." remarks, was indicated in our description of Mr. Carvalho's beacon, in September last. That principle is, that the moorings of the beacon should be attached to it at the height of the point at which the resultant pressure of the stream intersects the vertical axis of the beacon. (Here we, of course, neglect friction.) It is this condition which M. Carvalho fulfils in his beacon. With regard to the entire submersion of buoys by the action of strong currents, as mentioned by Mr. Findlay, we may remark, that the only way to remedy the evil is to increase the displacement of the buoys. We offer no apology for these comments, as we believe the success of the proposals which Messrs. Findlay and Herbert have so much at heart, depends upon the facts to which we here direct attention.—EDS. *Mechanics' Magazine.*]

time, forms a step for the mast or pole. The beacon is formed of a series of hoops or half-hoops, which may be painted red, to enable them to be better seen at a distance. The improved buoy is ballasted so that its centre of gravity falls below its centre of form, and if situated in a current, would swing across the tide,



and itself float upright, while the rods were inclined at an angle more or less great to the surface of the tide. Such a buoy would be particularly valuable in those Indian rivers where the current is strong, and in which it frequently happens that the existing buoys will not "watch," as it is termed,—that is, keep upright and in sight.—(*Mechanics' Magazine*, September 12, 1857.)

SOUTH KENSINGTON MUSEUM.

During the week ending 6th March, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 2,044; on Monday and Tuesday, free evenings, 2,105. On the three Students' days (admission to the public 6d.), 472; one Students' evening, Wednesday, 48. Total 4,669.

Home Correspondence.

LIGHTHOUSES.

SIR,—In the discussion on Mr. Findlay's paper on Lighthouses, on Wednesday evening last, your reporter has in some way misunderstood me, and consequently has not reported my remarks quite correctly. He makes me say, "That I had the testimony of Mr. Brooking, one of the Newfoundland Light Commissioners, that a face of three of these deep reflectors was capable of being seen, in all states of the atmosphere, at a distance of over thirty miles, and I knew of no other description of reflector of which, with the same number of faces, the same results could be recorded." What I really did say, was, "That I had the authority of Mr. Brooking, one of the Newfoundland Lighthouse Commissioners, that a light, with three of these deep reflectors on a face, could be seen over thirty miles in the ordinary state of the atmosphere, and I did not think the same could be said of the Huddart reflector, with only the same number on a face."

I am, Sir, your very obedient servant,

WM. MATTHEWS.

367, Strand, London, March 8, 1858.

NEW ZEALAND AND ITS RESOURCES.

SIR,—In the discussion which ensued on Mr. Stones' paper on New Zealand, my friend Mr. Sidney rather questioned my statement of its grazing capabilities, remarking:—"He would also warn intending emigrants against the idea that, whereas, without cultivation, they could feed three sheep per acre, with cultivation, they could feed six sheep per acre. Those were statements, he apprehended, taken from New Zealand hand-books. The fact was, that the land best adapted for sheep-feeding was just that which was not fit for cultivation, &c."

I may be permitted, in corroboration of my remarks, which were derived from New Zealand colonists and New Zealand journals, and not from hand-books or overdrawn statements, to quote an extract of a letter I have

just received from my brother, who writes to me from Plymouth, as follows:—

"I have read the paper of Mr. Stones, and your remarks, &c., and think them very good, and certainly unbiassed. With respect to the wool, I have heard at Sydney that the New Zealand wool is very much superior to the Australian, from the fact that the wool never stops growing, as sometimes occurs in New South Wales and other parts of Australia; therefore, the fibre is of uniform thickness throughout, and fetches a higher price in the market. I know one place, Pakaraka—Archdeacon Williams's place,—near the Bay of Islands, where eight sheep are fed all the year round on one acre of pasture land, sown with English grasses. I have seen and know this myself. I intend sending a copy of the *Journal* to my friends at Auckland, and the paper will appear in the local journals."

This statement will, I think, bear out the opinions I advanced. I am, &c.,

PETER L. SIMMONDS.

8, Winchester street, Pimlico, March 4, 1858.

STEEL-BORED ORDNANCE.

Sir,—Absence from home prevented my seeing Mr. H. W. Reveley's remarks in the *Journal* of the 5th Feb. sooner. I am sorry to say I can see nothing in that gentleman's letter to induce me to alter the opinions expressed by me on the 29th Jan.

With your permission I will examine more closely into the merits of Mr. Reveley's plan. I stated that "the welding of such a mass of steel was open to serious objections." Mr. Reveley corrects me on this head, and in support of his theory, instances the welding of ordinary gun barrels. The ordinary barrels are not welded from a spiral coil, but from a flat *iron* bar, called a "scelp," 13 inches long, six inches wide, by half-inch thick; this "scelp" is passed through elliptical rolls, and drawn taper, then through a series of grooved rolls and brought into a cylindrical state, and afterwards welded on a cold mandril by passing through elliptical grooved rollers; the barrels thus treated are passed through the rolls fourteen times, and are heated each time; the barrels of all the ordnance rifles are made in this way; sporting gun barrels and the better class of barrels are made from a spiral coil, a plan which is, as Mr. Reveley justly remarks, extremely simple, and they are welded at *one heat* by "jumping;" a barrel made in the way described weighs, in the rough, some 8 or 10 lbs., and measures 30 or 40 inches in length, as the case may be, these being the standard lengths of the Enfield rifle barrel. These barrels are all made of malleable iron or iron and spring steel; a barrel of cast-steel is a rare exception in this country, but common in America, where they are bored out of the solid bar.

The spiral bore Mr. Reveley proposes to employ in the manufacture of his large ordnance will weigh upwards of four tons, measuring 12 feet in length, by 18 inches in diameter in the finished coil. To form this spiral, a bar of steel would be required 162 feet long by four inches square; we will conceive this mass of steel in a coil, ready for the welding operation. A furnace is required to heat it in at least 14 feet long, and it must be borne in mind that it is not the surface only that must be brought to a welding heat, but the *edges* of the coil, and this, too, uniformly throughout; a little too much heat in any one part damages the whole; if underheated, no weld takes place. If it is proposed to weld it piecemeal, a portion of the previous welded part must be brought up a second time to a white heat. The "jumping" of four tons of steel will not be such an easy or simple matter as "jumping" a gun barrel weighing 10 lbs.; some machinery must be exployed to lift it, and the probability is, that by the time it is ready for the "jump," the metal will be too cold to adhere. I think I need not point out to Mr. Reveley that the surface will be in a welding state long before the sides.

We next come to the crystallisation of the surface. Mr. Reveley says, "large quantities of chilled cast-iron are used for a variety of purposes, and I never yet saw the iron mould affected by the melted metal." This statement is beyond question, but I cannot see any ground of comparison between chilled cast-iron and the question at issue. By pouring cast-iron into a metal mould, the temperature of the iron in immediate contact with the mould is instantly lowered, but not so with the internal iron; the "chilling does not penetrate beyond an inch or an inch and a half, and for some time the metal internally remains in a fluid state. I presume Mr. Reveley would cast the "jacket" round the bore in sand, and heat the bore before placing it in the moulding box, to prevent "chilling," which would be destructive to the "jacket;" if not heated, two errors will be fallen into—first, the metal will be chilled and its brittleness increased, and secondly, it will rend in various places, for, while the cast-iron is contracting the steel is expanding. Whatever the treatment may be, the result will be the crystallisation of the outer surface of the coil; to prove this, Mr. Reveley has only to take a bar of such steel as he purposes to employ for his coil, and then plunge it into a ladle of molten cast-iron, and then test the result. Of course it must be left in the ladle till the iron is set.

In treating of the shrinkage, I cannot admit that the core "is at a low degree of heat;" it must be brought up to the same temperature as the surrounding fluid, and the particles of steel on the outer surface of the coil will be expanded to their utmost limit, thus bringing it again into the same—if not a worse—state than unhammered cast-steel. Both cool together, the steel contracting in a greater ratio than the iron—but whether so great as to be seriously detrimental to the supposed ordnance, actual test alone can decide.

We now come to my own experimental cannon. I am sorry I did not express myself so clearly on the method of construction as to prevent any wrong impression being entertained by Mr. Reveley. The bore was cast hollow, four inches square, and was hammered, or, if Mr. Reveley prefers the term, drawn, down on a mandril to 2½ inches diameter, cold-hammering being carefully avoided; this gave it its full cohesive strength.

I am, &c.,

W. HAWKSWORTH.

Avon Steel and Iron Works, near Linlithgow, Feb. 15, 1858.

STEAM PLOUGHING.

Sir,—Allow me to inform Mr. Homersham that the Stirlingshire Agricultural Society's judges are in error, for I have ploughed the whole of fields without shifting. As an instance of what I am prepared to do, and publicly, if required, I will take a field on my own farm (it contains 13 acres, with one straight and three not straight fences), I will set the engine, windlass and tackle down, and plough the whole of it, including the headlands, without shifting the engine and windlass, leaving less in the four corners than is usually left when ploughing is done with horses.

I am, &c.,

W. SMITH.

Woolston, Feb. 22, 1858.

MEETINGS FOR THE ENSUING WEEK.

Mon. Royal Inst., 3. Prof. Huxley, "On Biology."
Statistical, 3. Anniversary.
United Service Inst., 8½. I. Mr. H. D. Cunningham, "On the History of Sails and Sail Power, and on Cunningham's Improvements in Reefing Sails." II. Mr. G. Biddlecombe, R.N., "On Steam Navy Tactics."

Tues. Royal Inst., 3. Prof. Huxley, "On Biology."
Civil Engineers, 8. Renewed Discussion, "On Submerging and Repairing Submarine Telegraphic Cables."
Statistical, 8. Mr. W. A. Wilkinson, "On Railway Terminal Accommodation, and its effects on Traffic Results."
Pathological, 8.

WED. United Service Inst., 3. Capt. Fishbourne, "On the *Leviathan* Steam Ship."
London Inst., 7.
Society of Arts, 8. Mons. F. R. de la Tréhonnais, "On the Past and Present of French Agriculture."
Microscopical, 8.
THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Philosophical Club, 5½.
Antiquaries, 8.
Chemical, 8. Messrs. Perkin and Duppa, "On the Action of Bromine upon Acetic Acid."
Linnean, 8.
Philological, 8.
Royal, 8½.
FRI. United Service Inst., 3. Mons. Soyer, "Military Dietetics, or improved System of Cooking for Army and Navy,"
Royal Inst., 8½. Mr. Henry Thomas Buckle, "On the Influence of Women on the Progress of Knowledge."
SAT. Asiatic, 2.
Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 5, 1858.]

Dated 10th February, 1858.

247. G. Richardson, 2, Copenhagen-street, Islington, and W. Richardson, 5, Ranelagh-grove, Pimlico—The construction of three-wheeled carriages, and omnibuses so constructed, as to be called first-class omnibuses.

Dated 15th February, 1858.

284. P. Molinari, Marseilles, France—An improved composition, to be used externally, for preventing sea sickness and illness arising from similar causes.

Dated 18th February, 1858.

307. E. Cuvelier, Arras, France—Improvements in steam engines.
309. W. E. Newton, 66, Chancery-lane—An improved optical instrument, which the inventor denominates a "Tropescope." (A com.)
311. J. H. Johnson, 47, Lincoln's-inn fields—Improvements in machinery or apparatus for making bolts and rivets. (A com.)
313. H. Blair, Kearsley, Lancashire—Certain improvements in the method of recovering the sulphur which has been used in the manufacture of soda ash, and in the apparatus connected therewith.

Dated 19th February, 1857.

315. J. Beatti, Lawn-place, South Lambeth—Improvements in locomotive and other steam engines, parts of which improvements are respectively applicable to other purposes.
317. J. Syers, Liverpool—Improvements in the decomposition of salt, and in the abstracting of metals from their ores.
319. R. Griffiths, 69, Mornington-road, Regent's-park—Improvements in screw propellers, and apparatus for governing engines used to give motion to screw propellers.
331. T. Brazenor, senr., and G. Brazenor, junr., Birmingham—Certain improvements in mill bands.
323. J. E. Cook, Greenock—Improvements in binnacles or apparatus for holding marine compasses.
325. W. Clark, 53, Chancery-lane—Improvements in filtering water, and in apparatus for the same. (A com.)

Dated 20th February, 1858.

327. R. Little, Glasgow—Improvements in machinery or apparatus for washing a d mangling.
329. W. Thomson, Glasgow—Improvements in testing and working electric telegraphs.
331. G. Gentile, 41A, Queen street, Cheapside—Improvements in ornamenting lace, netted, knitted, and woven fabrics.
333. F. M. Baudouin, Paris—Improvements in electric telegraph cables.
335. H. Rey Rimels, Brussels—A new process of manufacturing potato meal or fecula.
337. W. Clark, 53, Chancery-lane—An improved rotary engine. (A com.)
339. G. Catlin, Brussels—Improvements in the construction and propelling of steamers.

Dated 22nd February, 1858.

341. G. Schaub, Birmingham—A new or improved manufacture of certain kinds of printing type and other printing surfaces.
343. W. Cory, jun., Gordon place, Gordon-square—An improvement in the manufacture of artificial fuel.
345. R. A. Brooman, 166, Fleet-street—An improvement in treating ores of precious metals. (A com.)
347. J. Potts, 24, Park-street, Southwark—Improvements in machinery for cutting and shaping toothed gearing.

Dated 23rd February, 1858.

349. R. Telford and M. Hope, Birmingham—Improvements in castors for furniture.
351. W. McLennan, Glasgow—Improvements in the manufacture or production of boots, shoes, and other coverings for the feet.
353. E. Shepard, Jermyn-street, St. James—An improvement or improvements in depositing metals and metallic alloys by electricity.
355. G. F. White, Mark-lane—Improvements in doors and other locks.
357. W. E. Newton, 66, Chancery-lane—An improved process for producing photographic pictures or designs on the surface of stone or metals, so that impressions may be taken therefrom by the process of lithographic printing. (A com.)

Dated 24th February, 1858.

359. S. Smith, Hyson Green Works, near Nottingham—Improvements in apparatus for insuring the correct action of the safety valves of steam boilers.
361. A. Hector, St. Cyrus, Kincardine, N.B.—Improvements in apparatus for taking or catching fish.
363. C. Girardet, Vienna—A new moveable shaft bearer, or supporter of coaches.
365. J. Petrie, Rochdale—Improvements in apparatus for regulating the flow of steam.
367. W. E. Newton, 66, Chancery-lane—The application to carts or other vehicles of apparatus for weighing the load contained in such vehicles. (A com.)
369. H. Browning, Avon-cottage, Clifton road, Bristol—An improved composition for covering iron and other ships' bottoms and other surfaces.
371. R. F. Miller, Hammersmith—Improvements in omnibuses.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

370. W. K. Foster, State of Maine, U.S.—An improvement in the manufacture of blades for pencil sharpeners or other articles of like nature.—24th February, 1858.
386. A. J. Dessales, 13, Rue des Enfants Rouges, Paris—Improvements in oil lamps for railway carriages, ships' cabins, and other purposes.—27th February, 1858.

WEEKLY LIST OF PATENTS SEALED.

March 5th.

2336. U. Scott.
2341. B. Sharpe.
2351. J. Eastwood and S. Lloyd.
2361. J. D. Dunnicliff.
2363. W. Crofts.
2389. J. Walmsley and T. Howard.
2409. E. Hayes.
2428. G. E. Dering.
2431. J. W. Burton and G. Pye.
2435. M. R. Leverson.
2439. W. H. Peake.
2486. M. Henry.
2487. G. Speight.
2513. R. Thompson and W. J. Nicholson.
2603. H. Edwards.
2633. Capt. G. Rhodes.
2831. A. René le Mire de Normandy.
2999. G. T. Bousfield.
3067. J. M. Préaud.
3107. J. B. Howell and J. Shortridge.
3137. A. René le Mire de Normandy.
3173. J. Wandsworth.
37. T. Greenwood and J. Batley.

March 9th.

2350. E. Lavender.
2353. H. Lawford.
2357. W. Jamieson.
2358. J. Fenton, W. Thomson, and T. Snowdon.
2364. G. Bruninghaus.
2367. J. Mills.
2370. S. Colbeck and W. H. Colbeck.
2386. A. Gray.
2442. J. Minnitt.
3185. F. O. Ward.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

March 1st.

478. R. Boby and T. C. Bridgman.
488. A. L. Garnier.

March 2nd.

466. W. G. H. Taunton.
481. C. Iles.
489. J. Lewis.
581. W. Lister.

March 3rd.

486. A. Hotchkiss.
562. H. D. Pochin.

March 5th.

504. J. Cooper.
505. William Weild.
522. J. Norton.

March 6th.

525. J. Bernard.
529. J. Bullough.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4064	March 4.	Self-acting Valve Ventilator	R. Ramage	55A, Holywell-st., Milbank, Westminster.
4065	,, 9.	Improved Gas or Air pressure Gauge	W. Reichenbach	33 & 34, Borough-road, Southwark.
4066	,, 10.	Metal for Forks, Spoons, and Ladles	R. F. Sturges	Birmingham.

Journal of the Society of Arts.

FRIDAY, MARCH 19, 1858.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday, the 24th April, at the Society's House, for which a card will be issued to each member; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit a member and two friends, ladies or gentlemen.

EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, Auditor	10	10
T. H. Bastard	5	0
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	£1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

EXAMINATIONS.—LOCAL BOARDS.

The following circular has been issued by the Local Board at Leeds in connection with the Yorkshire Union :—

The Leeds Local Examinations Committee and Board of Examiners, in Aid of the Society of Arts Examination Scheme.

Leeds, 22, East Parade, March , 1858.

To the President and Committee of the * * *

Gentlemen,—Your immediate attention is respectfully solicited to the following statement :—

In accordance with the general plan of the Council of the Society of Arts for the present year, a Committee and Board of Examiners have been formed for this locality, to assist in carrying out the Examination scheme of the Society. The operations of this Committee and Board will extend to all Institutions in and around Leeds who may wish to avail themselves of their aid, and, indeed, to any others in Yorkshire that may desire to send Candidates to Leeds for Examination.

According to the "Examination Programme" of the Society, it will be required of Candidates that they undergo a "Previous Examination."

1st. To test their Handwriting and Spelling.

2nd. To test their knowledge of English Grammar and Composition.

3rd. To test their knowledge of the Elementary Rules of Arithmetic, including the Rule of Three.

4th. To test their knowledge of the *Special Subjects* in which they desire to be examined by the Society's Board of Examiners.

Candidates who satisfy the Local Examiners at the "Previous Examination" as to their acquaintance with the simple and elementary branches of study referred to, and also as to their knowledge of the *Special Subjects* upon which they desire to be examined, are regarded as "Passed Candidates," and are therefore eligible to undergo the "Final Examination," which will be conducted under the supervision of the same Local Board, but by means of written papers sent from the Society of Arts.

The previous Examinations will take place at Leeds, on Tuesday, April 6th, and Wednesday, April 7th, beginning each day at 10 a.m.

Persons who purpose to come forward as Candidates, will please to signify their intentions to the Committee, if possible, on or before Saturday, March 27th, and, at the very latest, on Wednesday, March 31st.

The Report of the Board of Examiners on the "Previous Examinations" will be laid before the Local Committee on Friday, April 9th, immediately after which the Candidates will severally be informed of the decision of the Committee on their eligibility. The precise date of the "Final Examination" will at the same time be communicated to each Candidate.

The following is the list of Local Examiners, with the Department assigned to each:—

Reading, Writing, Arithmetic, English Grammar, and Composition..	Mr. H. E. Kincaid, M.A., Head Master of the Leeds Mechanics' Institution and Literary Society's Schools. Mr. A. Oliver, Principal of Woodhouse Academy.
Geography, English Literature, and History......	Mr. A. Oliver.
Mathematics and Book-keeping........................	Rev. Henry E. Phillips, B.A., Incumbent of Christ Church. Mr. H. E. Kincaid, M.A.
Chemistry	Mr. Thos. Scattergood, Surgeon, and Lecturer on Chemistry at the Leeds School of Medicine.
Botany	J. D. Heaton, Esq., M.D. Lond., late Lecturer on Botany at the Leeds School of Medicine.
Physics	Mr. Alexander M'Ivor, Certified by the Government Department of Science and Art as a Teacher of Physical Science.
Physiology	Mr. Claude Wheelhouse, Surgeon, and Lecturer on Anatomy and Physiology at the Leeds School of Medicine.
Political and Social Economy........................	Mr. James Hole, Hon. Sec. Yorkshire Union of Mechanics' Institutes.
Classics and Roman History	Rev. C. E. Moberly, M.A., Second Master, Leeds Free Grammar School.
French	Mons. Brocard, Teacher of French Language and Literature.
German	Herr Reunert, Teacher of German Language and Literature.
Drawing	Mr. John White, Head Master, Leeds School of Art. Mr. Charles Ryan, Assistant Master, Leeds School of Art.

N.B. No Candidate will be examined in more than three *special* subjects.

EDWD. BAINES, Chairman *pro tem.*
ALEX. M'IVOR, Secretary.

FIFTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 17, 1858.

The Fifteenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 17th inst., Sir Thomas Phillips, Member of the Council, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Fenn, Joseph	Hedley, Thos. Abercrombie
Healey, Elkanah	Roney, Sir Cusack

Sheppard, T. B. W.

The Paper read was:—

ON THE PAST AND PRESENT OF FRENCH AGRICULTURE.

By F. R. De la Trehonnais.

The proud position which English agriculture has taken amidst the arts which, by their excellence, characterise the civilisation of our age, has necessarily drawn upon its progress and development for the last fifty years the attention of the whole world. Improved means of communication have induced foreigners to come and visit English farmsteads and agricultural exhibitions, whilst international shows have enabled still greater numbers to gaze upon the wonders of English industry, by placing in conspicuous evidence the excellence of England's breeds of cattle, and the singularly effective ingenuity of her agricultural implements. There is in progress this providential economy, that its diffusion obeys similar laws to those which regulate the transmission of light, sound, and heat. Like these natural phenomena, progress will radiate, expand from the centre of its existence, and diffuse itself all around, in spite of routine and opposition, until a perfect equilibrium is established. Hence the eagerness manifested by other communities, some immediate neighbours to this island, some dwelling at its very antipodes, to come and copy English systems of practical husbandry, study English experience in every branch of agricultural economy, and obtain English cattle, implements and seeds, that they may in their turn, with all the advantages of more favourable climates, reap the benefits of improved practice based upon sound theory.

This intercourse in the case of France, whose agriculture is the subject of my paper, fostered by the close proximity of our respective shores, rendered more intimate by the links of a political, and, I trust, national and popular alliance, and made still more practicable by means of the international shows which have lately taken place—this intercourse, I say, has naturally excited among Englishmen a greater interest in the agricultural status of France than in that of any other nation.

A few years ago a gifted French economist, M. Leonce de Lavergne, wrote a book on the agricultural economy of Great Britain, in which, in order to bring out the facts upon which he based his arguments in a more conspicuous manner, he compared statistical and economical statements about the condition of England and France, and it must be admitted that the inferiority of the latter, in every branch of her agricultural economy, was most forcibly established. My object this evening is not exactly to impugn that position, but rather to explain and qualify it, and then to show that, after all, there are, in the past, and especially in the present state of French agriculture, many causes of pride and honour, which give it a place, not unworthy the greatness which France has gained in other arts and achievements, and which, I hope, continuing to develop themselves with that steadiness and persevering energy which are the true characteristics of progress, will, ultimately, not in antagonism, but in noble rivalry with English excellence and perfection, reach at length that desirable degree of efficiency and productiveness which is the surest and safest element of national independence and prosperity.

French agriculture has not always stood in so great an inferiority to that of England, for there

was a time when it was so flourishing that the supply of grain to England was mainly dependent upon French harvests. History tells us that up to the 16th century, England and Scotland were so far behind in industrial and agricultural pursuits, that Francis I. had to send over to this country two artisans of each trade, and several sets of agricultural implements. Even in the time of Queen Elizabeth, England was almost exclusively dependant upon Belgium and Flanders for her supply of vegetables, and it was from these provinces that she obtained her first notions of improved husbandry.

A glance at the history of England up to that period is sufficient to account for this comparative inferiority. War, especially civil war, and agriculture have two widely different objects; the one is production, the other destruction; and it is obvious enough that, as long as intestine wars raged over this country, a state of barbarism in arts, as well as in manners, must have been the lamentable and inevitable result.

To the same cause, in a great measure, and to others, to which I shall presently allude, must be ascribed the great neglect into which French agriculture was suffered to lapse, from the commencement of the seventeenth century up to within the last few years, when unmistakeable symptoms of revival have manifested themselves, with a degree of energy and earnestness which bids fair for a speedy regeneration.

In order to measure, as it were, the extent of the decline of French agriculture, and to form a correct estimate of the progress that has been lately made, I will describe, in the first place, what was the status of agricultural practice in the sixteenth century, and compare it with that of modern times. I conceive that by so doing I shall best succeed in giving a clear and comphehensive idea of the history of agriculture in France for the last three hundred years.

I have selected the sixteenth century as a starting point for our inquiries, not only because that time was, in my opinion, the most prosperous and flourishing period of the history of French agriculture, but because this is the earliest date when there is any record of agricultural science and practice to be found in the annals of French political economy. I allude especially to the remarkable work of Oliver de Serres, entitled "The Theatre of Agriculture," which gives, in a full and clear exposition, a complete account of agricultural practices and notions in his time.

The perusal of this curious work, which is very little known, although often spoken of, fills one with astonishment, not to say humiliation for our present boastful age.

It is the fashion now-a-days to expound alleged new ideas and theories, to point to practices, the efficacy of which is everywhere recognised and admired, as the discoveries of our times. Subjects are daily discussed, conclusions are drawn in public meetings and newspaper leaders, as if they had burst for the first time upon public attention. We frequently have to listen to learned disquisitions upon the rotation of crops; the so-called theory, and, still more so, the practice of drainage; the various modes and means of preparing the land; the selection of seeds; the necessity or, at all events, the usefulness of meteorological observations; the equalisation of weights and measures; the duties of employers towards their labourers; the principles of leases; the economy of the management of landed property, &c. We are wont to engross our minds with the consideration of all these topics, and those who undertake to lecture us upon them seem to handle those subjects as if they were presented for the first time to the attention of mankind, as if they were new questions only just arising from the force of the progressive development and wants of our civilisation. And yet, those who love to dwell on the past, those who are not dismayed by the forbidding aspect of musty books, and feel more interest in the investigation of historical lore than in the stale and hackneyed topics of modern literature, know well that all these subjects were handled and discussed by our forefathers with a degree of knowledge and experience which brings the blush to our cheeks, and proves that, with all the wondrous advantages we possess, the application of a new and powerful motive power to farming operations, our improved implements, and especially the truly marvellous discoveries of science, the progress we have made in the practice of agriculture is comparatively very slight indeed,—and, if we except the application of steam, which is far from general even in this country, where there are still some advocates of the flail to be found, the improvement of agricultural herds of animals, and the invention of a few really useful implements, the present state of agriculture in Europe can scarcely be said to have participated in the immense stride accomplished by those other branches of the civilisation of the world which chiefly depend upon the ingenuity of men. This I do not mean as a reproach to modern agriculturists, for that stationary position which looks so much like an anomaly in the midst of the general progress, can easily be accounted for. Agriculture being the most ancient, as it is the most necessary of human arts, is naturally the topic which has most engrossed the attention of mankind from the earliest times of the world's existence, therefore the amount of agricultural experience and knowledge recorded and handed down from generation to generation, naturally greatly exceeds that which the tradition and history of other arts can bring forward as the incentives and means to their progress.

During the feudal tyranny of the middle ages, French agriculture, in common with that of all other countries regulated by the same social laws, participated in an especial manner in the frightful disasters of that turbulent period. The slave-like condition of the peasantry, the uncertainty of their ever reaping the fruit of their labour and industry, their constant withdrawal from their fields to go and fight their restless lords' battles, the lawlessness of armed bands, ever ready for pillage and destruction, the division of the surface of the land into many petty states, under rulers, absolute, and in most cases tyrannical, to an excess unparalleled in the annals of history—chieftains acknowledging no other law but the whims of their unbridled passions, and ever making inroads into the territories of their neighbours with fire and sword, all these untoward characteristic circumstances of the long and disastrous period of our mediæval history, made it a matter of absolute impossibility that even the faintest gleam of progress in agriculture should manifest itself amidst the general darkness, that hung like a sinister cloud, over the annals of the first half of that period. It was only when the Kings of France, from the time of Lewis XI., began to put a curb upon their vassal lords, and gradually relieved the exhausted population from the incubus of feudal serfdom, that agricultural prosperity sprang from the kindly soil of France, and began to shed over all classes of society, revived with the aspirations of comparative freedom, the blessings of plentiful and secure harvests.

Under Louis XII. the grinding taxes which had exclusively been laid upon the tillers of the soil, were greatly relaxed. Under that king so justly surnamed the father of the people, agriculture began to flourish; and had it not been for the disastrous and continued foreign and religious civil wars of his successor, Francis the First, no doubt but the national prosperity of France would have enabled her to weather with less damage than she did, the frightful trials of the 18th century.

Under Henry the IV. French agriculture seems to have reached the highest point of prosperity of which its history can boast. Never in the annals of France had the population been so near the realization of that good king's celebrated wish, that every one of his subjects should be enabled to boil a fowl for his dinner. The results of an enlightened commercial policy, granting to agriculture that freedom without which it cannot

prosper, were manifest in the increase of production, which ever brings in its train increase of population. The owners of the land were wont to reside in their chateaux, and by bestowing a large share of their attention on the sources of their incomes, gave rise to a friendly intercourse between themselves, their tenants and labourers, which tended to elevate the latter, and enlighten the principles which guided their pursuits. It was in that happy reign that lived Oliver de Serres, and the immortal work which he wrote upon the agricultural status of his time will remain to the end of ages the worthy monument of a period of prosperity, which cannot be said to have been equalled even in our time.

But, alas! that prosperity was not to last; the hand of an assassin put an end to the life of the good king under whose rule it had been fostered and protected, and with his blood it seems as if the tide of progress and civilisation, peace, and religious tolerance, had ebbed from the kingdom of France, and left it the desolate arena of dissensions, and plunder, exactions and massacres, lawlessness, dire centralization and famine.

The limits of this paper do not allow me to dwell upon the political influence of historical events, or on the ruin of agriculture during the fatal period extending over the 17th and 18th centuries, further than to point out the bias of Richelieu's policy under Louis XIII. He favoured industry and commerce at the expense of agriculture, which he held in utter contempt, not to say enmity. But however disastrous that exclusive policy might have been, it was reserved to the centralisation effected by Louis XIV., in order to gratify that inextinguishable thirst for pompous display which devoured him and all those whom he drew around him, to strike the heaviest blow to agriculture, as an industrial pursuit and a national interest. This centralization, which gathered around the throne a crowd of courtiers anxious for the sunshine of courtly favours, estranged the nobility from the tillers of the soil, and reduced the latter to that degraded state of misery, ignorance, and inaccessibleness to improvement from which they have scarcely begun, even now, to emerge. Under Louis XVI. a new era dawned upon France, exhausted by the folly and disasters of the two preceding reigns. Partly owing to the enlightened mind and the personal virtues of that unfortunate monarch, so effectually seconded by his minister Turgot, partly from the pressure of the new ideas, which the freethinking and infidel philosophy of the 18th century had diffused throughout society, great reforms were actually made and still greater ones were planned. These improvements in the condition of the French people soon imparted to agriculture a new life, when unfortunately the hurricane of the French revolution, and the imperial wars that followed, blew over the land, scattered under its blast the last elements of progress that remained, and threatened to bring back the French people to a state of utter barbarism, by destroying all the bonds which hold communities together—charity, benevolence, and Christianity.

Under the first Napoleon, the drain of able-bodied men was so great, that agricultural labour was almost exclusively left to the feeble hands of women and old men. Even now, although several generations have intervened, the deficiency of male labour is still lamentably apparent, and all travellers, through the eastern provinces of France especially, can testify to the fact that there are still more women than men to be seen in the fields.

Since that period a steady but very slow progress has been accomplished, although for many years it was scarcely perceptible. I shall presently examine the various causes which have been assigned for this stagnation of agricultural progress. These causes are many and serious, and as, after all, their investigation is more immediately interesting and useful as it may tend to their removal, than a lengthened disquisition on the past history of agriculture, however alluring and pleasant this might be, I will now give a rapid sketch of what the notions and practices of agriculture were in the time of Henry IV., and devote the rest of my paper to its present state and future prospects.

Among the general notions by which agricultural operations were guided and determined in olden times, one of the most strange, and, to us, most contemptible, was the singularly scrupulous attention paid by the agriculturists of that time to the influence of the heavenly bodies, and especially to that of the moon. This superstition has, in a great measure, disappeared from France, but at the time when Oliver de Serres wrote his book, although he faintly ridicules it himself, and especially states that no great confidence should be given to astrological prognostics, yet he appears to be under the sway of the general belief in that influence, and even lays down rules for the observance of certain periods of lunar phases, in respect to field operations. The origin of this superstition is, no doubt, to be traced to the influence of our planet's satellite upon the meteorological phenomena of our atmosphere—that influence had been remarked in times of the remotest antiquity, and the observing experience of generations deprived of the light of science, naturally allowed it to degenerate into an absurd superstition. But it so happened that these prognostications, which in one district were deemed favourable for a peculiar operation, were looked upon as forbidding it in another. It had been enough for a man to observe that under a certain position of the moon such-and-such an operation had succeeded or failed, to lay it down as a rule that under similar accidents the same result must accrue,—*Post hoc. propter hoc*, being, but too often a logical axiom among the ignorant. In our times many superstitious prejudices exist, no doubt, but I am not aware that they exercise any degree of influence over the practice of modern agriculturists. These ideas, although indicating the status of scientific knowledge in those remote times, are not entitled to much consideration, for the rules by which astrological prognostics were applied to agriculture were at complete variance with one another in different districts, and even in neighbouring parishes. These rules were embodied in rhymes, in order to be more easily preserved by tradition, and are remarkable only for their quaint absurdity; not so with the other axioms which we find in the popular languages of all nations, in the shape of short, pithy rhymes, which, handed down from generation to generation, seemed the sole vehicle for the store of practical knowledge which, by means of this oral tradition, was preserved to posterity. In our time we have cheap books and a cheap press, but before the invention of the art of printing, and even long after, these popular proverbs were the only practical records of the world's experience in agriculture. I say practical, for the works of Columella, Virgil, Pliny, Palladius, &c., were utterly unknown, even through the names of their authors, to the mass of the population, and especially to that portion immediately interested in the subject of which they treated. I wish time allowed me to quote here a few of the proverbs with which the work of Oliver de Serres is so abundantly interspersed. We should find in them a quaint but thorough record of acute and practical observations and maxims, which by their wisdom would corroborate many axioms and principles laid down as new discoveries in the practice of modern agriculture.

That most ancient implement, the plough, seems to have engaged a large share of ingenuity at that time. The necessity of thorough pulverisation, subsoiling, the desideratum of the spade-like effect of the plough upon the land, were fully recognised, and we have the description of a roller, not unlike Mr. Crosskill's, which I am sorry to state is now completely unknown in France; indeed, if we compare the common implements of modern French agriculture, that is, those which are used by the

bulk of the peasantry, with those which seem to have been in use in the 16th century, the latter must appear vastly superior. The description of this roller, as given by Oliver de Serres, deserves a translation:—

"From the labour of men engaged in that operation (viz., the pulverisation of the soil) great expense must ensue, on account of the time it takes. To spare that expense, an instrument has been invented of so good service, that by means of it a single man, with one or two beasts, moving it through a field, breaks more clods than ten men with spades and clubs would do. It is a large rolling harrow, composed of two cylinders or rollers as large as the cylinder of a weaver's loom, and covered with strong iron spikes, which, by the movement of the rollers, pass over the clods and crush them entirely. The weight of this harrow must be regulated by its intended effect, so that an adequate pressure may be made in order effectually to pulverise the soil."

This looks very much like a most happy combination of the harrow, clod crusher, and roller, and is, in fact, not unlike what is called in England the Norwegian harrow. I know not whether it is still in use in any remote part of France. All I can say is, that I have never seen or heard of it. The heavy plough, with wheels, drawn by four, five, or six beasts, the light plough, without wheels, and drawn by two beasts only, the double mould board, the subsoil ploughs, &c., were all in use, and considerable discussion seems to have existed about the respective merits of using horses or oxen, which shows that that question has not advanced a single jot since that time, for discussion about this point is still rife in France, and fills no inconsiderable space in agricultural periodicals and newspapers.

The equalisation of weights and measures, now so happily realised in France, and still a theme of discussion in this country, was considered in those times a desideratum of great importance. I am obliged, through want of time, but much to my regret, merely to allude to all these interesting topics, and to confine myself to the bare mention of them, in order to show what were the ideas of agriculturists, and to offer a term of comparison for the appreciation of the progress that has been made. Another great question, which although so generally practised in this country, yet is still a theme of many animated debates, I mean land drainage, appears to have been as fully appreciated in those times as in our own, and much more extensively practised than it is now in France. The means employed were, indeed, somewhat different, but the principles from which the practice is deduced were as fully known and understood as they are now. Tiles do not seem to have been known; instead of them, thorns, brambles, and even straw were recommended—a mode still in use even in England, where I have heard it strongly upheld by a man who is deservedly looked upon as a teacher in agricultural practice. Even the Keythorpe system is alluded to in De Serres' work, when he speaks of the difficulties presented by the heterogeneous nature of the subsoil.

The hoeing of rising crops, the frequent turning of the soil, the careful extirpation of weeds, the ploughing of land immediately after the harvest, especially when intended for bare fallow, the cultivation of green crops, and the good effect of their being ploughed into the soil, the great superiority of spade cultivation over any other, the importance of quick-ploughing of the land, in order to profit by favourable seasons, by means of changes of oxen, so that no delay should ensue from resting-time,—(a desideratum towards the attainment of which the efforts of our modern agricultural engineers are now energetically devoted, by the adaptation of steam-power to the cultivation of the soil), &c., in fact, all the most interesting and practical questions bearing upon agricultural progress were fully known and appreciated, to such a degree, that, were it not for several advantages we have lately gained from the discoveries of science, the remarkable work in which all of them are expounded might most reasonably become a text-book for practical agricultural students, even in this country.

As regards the practices of modern agriculturists in France, if we except a few spirited land proprietors, the bulk of the tillers of the soil are far more ignorant than they appear to have been three hundred years ago; for, indeed,—although no difference can be perceived in their modes of carrying on the leading operations of husbandry, such as the preparation of the soil, manuring, sowing, and harvesting, in which respects they may be said to have remained stationary,—they are infinitely behind in the general management of the farms, as regards the economy of the details, such as the care of manure-heaps, the construction of farm buildings, the breeding and care of stock, the preservation of produce, the economy of labour, and espeically the theory and practice of drainage, the very name of which is still a word without any meaning with the majority of the French peasants.

With this rapid and incomplete sketch I will now dismiss the past. The present, with its stern actuality, its anomalous phenomena, and its immediate importance, has much greater claims upon our attention. I will therefore devote the remainder of the time allotted to the reading of my paper to the present state of French agriculture.

One of the greatest economists of modern times, one who may be called the father of political economy—Malthus, laid it down as a rule that the increase or decrease of population was exactly in the same ratio as the increase or decrease of the production of food.

The history of the last ten years throughout Europe affords a sinister illustration of that principle.

All at once, without any warning, a mysterious disease fell like a plague upon the potato crops of Europe, the stalks withered and blackened as if an avenging flame had passed over them, and the precious tubers, relied upon as the sole sustenance of millions of our fellow-creatures, rotted in the ground, and became a mass of putrid decomposition that even poisoned the air. It was the most awful visitation which our modern times have witnessed. In Ireland alone, one million human beings were swept from the land by the awful stroke of famine, and two millions more hastened away from the shores of that desolated island from sheer want of food, and emigrated to the United States and elsewhere. Thus a portion of this prosperous empire exhibited, within the affrighted recollections of all of us, the lamentable spectacle of a wholesale destruction of human beings from hunger, a calamity we thought only possible in remote ages of barbarism, times of savage ignorance, and impotence.

Here, then, we have an appalling instanee of a decrease of population being caused by a deficiency in the supply of food. A close examination of similar facts throughout history, especially since the comparatively modern period, when the census became a regular operation in all the states in Europe, will show that there is no instance of decrease of population in any country, that is not directly traceable to a decrease in the supply of food.

Wars and epidemics may, it is true, exercise a marked influence upon the population of a country, but these causes of mortality are nothing when compared with insufficiency of food supplies. Indeed, when viewing the phenomena of the social economy of nations from this light, when measuring the deep influence which the supply of bread and meat exercises over communities, how it sways their moral* and material status, how the progress and grandeur of empires oscillate with the fluctuations in the prices of food, and how civilisation itself, with its lofty monuments of arts, wisdom, and liberty, hangs trembling in the fickle balance of plenty or scarcity, it makes the mind shudder with inquietude and terror, and causes reflecting men to turn with increased

* It is well known that crime is much more rife when food is dear than when it is cheap.

solicitude and earnestness towards the progress of agriculture, which is so immediately and momentously linked with the progress of our race.

If, then, the movement of the population of a country be a reliable criterion of its agricultural production, we have only to look at the statistics of the population of France for the last few years, and we shall then form a correct estimate of the capabilities of her agriculture for the production of food.

Anyone looking at the geographical position of France—her favourable climate—the natural fertility of her soil—the happy variety of her surface, presenting every accident of the earth's crust; mountains and plains, gentle hills and rich valleys, broad streams intersecting its length and breadth, the genial warmth of the south combined with the moist temperature of the north, rapid germination of seeds, early maturity of harvests, uniformity of seasons, &c., &c., would naturally think that such a country was capable of supporting a very large population, and that the only evil attached to such prosperous and favourable circumstances, would be an excess of population, which would engender the usual concomitant scourges of epidemics, pauperism or emigration on a wholesale scale. Alas! it is the very reverse, which is is now my grievous duty to describe.

A short time since, a powerful organ of the English press, and a celebrated Scotch review, raised a cry that France was degenerating and getting lower and lower in the scale of the human race. These statements were read with astonishment, and in many cases, no doubt, with disbelief, and yet the facts from which those conclusions were deduced are but too true. The census of 1856, in France, showed with the brutal—but plain and unvarnished logic of figures—that, whilst in every country in Europe population was steadily increasing, France exhibited a lamentable decrease, for during the years 1854 and 1855, the number of deaths greatly exceeded that of births.

Superficial writers might, indeed, naturally infer from such a phenomenon, that the French race had reached a period of degeneracy and impotency, but the cause lies elsewhere, for I will show presently that the number of marriages had also sensibly decreased ever since 1850, thus accounting, in a certain measure, for the decrease of the population. The fact of this extraordinary phenomenon cannot be ascribed to any other cause but insufficiency in the supply of food. The high prices which, up to the present time, have prevailed in Europe ever since 1853, connected with the Russian war, which drained the country of money and men, paralyzed, in a sensible degree, agricultural operations; and French agriculture, deprived of capital, as I will presently show, destitute of that improved machinery, which goes far to supply the lack of hand labour, was wholly unprepared for this sudden call of active men which depopulated her villages and for that drain of capital, which was swallowed up to an untold degree imdiately by the popular Government loans, and indirectly, but not less fatally, by the enormous sums of money spent in the purchase of foreign supplies. To these causes we must add the unfavourable temperature of those eventful years, which, in undrained land and impoverished soil, fatally reduced the yield of harvests.

But, however satisfactorily we may account for this deficiency in the supply of food during the last five years in France, this does not explain why other countries, which, during the same period, were placed in precisely similar circumstances, did not exhibit the same retrograding symptoms in their prosperity, for, on the contrary, in spite of these adverse circumstances which told with such remarkable severity in France, they steadily persevered in their onward career of progress and prosperity. But, in order to obtain a still more convincing proof that the cause of the slow increase of population in France is directly traceable to the insufficiency in the supply of food from the low status of agriculture, let us examine the statistics for the last 50 years.*

In 1790, from a census, decreed by the Constituent Assembly, the population of France was found to be 26 millions and a-half; 25 years afterwards, in 1815, it was most likely 29 millions and a half, which gives an increase of three millions—notwithstanding the frightful wars that raged during that whole period. Thirty years after, in 1846, the population had reached 35,400,000, increase, six millions; ten years after, in 1856, it was only 36 millions, which gives an increase of only 600,000 souls.

From the foregoing data it will be seen that, during the revolutionary and imperial era, population increased at the rate of 120,000 per annum; during the monarchical period which ensued, at the rate of 200,000; and, during the ten years which have elapsed since 1846, the average is only 60,000. I say, *average*, for ever since 1850 the proportion has been still less. In 1849, immediately after the revolution, the disquietude and stagnation into which all the interests of the French people, and especially that of agriculture, were suddenly thrown by that fatal event, were made manifest by a sudden decrease in the number of births, which exceeded that of deaths by only 13,000, notwithstanding the plentiful harvest of 1848—which, however, barely sufficed to fill up the deficiency caused by the famine of 1846-47. In 1850, a reaction took place; confidence was restored to a certain degree; the violent scenes exhibited by an unhinged society had ceased; the population, comparatively less disturbed, returned to their labour; the production of food increased, and with it the population, which, in that year, showed a surplus of 187,000 births. In 1851, 1852, and 1853, however, the downward progression began; in 1852 the surplus of births, which, in 1845, was 237,000, came down to 154,000; in 1853, to 142,000; but in 1854, that downward movement crossed the line, and appeared on the lower side with a grim surplus of deaths over births of 69,000. The year 1855 exhibited the same mournful phenomenon, although in a lesser degree; the surplus of deaths reached only 37,074. Thus, in two years, while every country in Europe exhibited a comparatively large increase of population, the numbers of the French people had actually diminished by 106,000.

Thus, to resume the picture of this lamentable decadence, I will state that from 1841 to 1846, a period of five years, population in France had increased by 1,170,000; from 1847 to 1851, this increase only reached 383,000; and from 1852 to 1856 only 256,000. Now, before we examine the cause of this phenomenon, let us see what was the relative position of other states as regards population.

In 1851 England was already twice as thickly populated as France at per square mile, and the excess of births over deaths averaged about 360,000 per annum. It is very true that in this country, as M. de Lavergne remarks in his paper upon the census of 1858, published in the *Revue des Deux Mondes*, the production of food supply does not keep pace with the increase of population; that production must, however, be considerable, because on the one hand emigration has greatly diminished, and on the other the importation of food is by no means adequate to the increase of population. It may then be safely inferred, that agricultural prosperity is the very foundation of the colossal power of England, the greatest the world has ever known, not excepting even that of the Romans, who never swayed power over more than 100,000,000 of men, whereas the British empire cannot be less than double that number.

Belgium, whose territory is but one-twentieth of that of France, from 1851 to 1856 increased its population from 4,427,000 to 4,607,000, which gives a surplus of

* For the following digest of statistical tables I am principally indebted to the remarkable articles on population, from the pen of M. Leonce de Lavergne, and lately published in the *Revue des Deux Mondes*.

180,000; at the same rate France should have gained 1,500,000, and, as I have stated, the increase of her population during that period was only 256,000.

In Prussia, where the census is taken every three years, the population increased by nearly one million in six years; at that rate, the increase in France ought to have been two millions.

In Holland, from 1850 to 1856, the population increased by 204,000, at which rate the increase in France should also have been two millions.

The decrease of population in France results from two sources. On the one hand the number of births has diminished; that of deaths has likewise increased. For instance, the number of deaths, which in 1853 had been 295,000, rose in 1854 to 492,000, nearly 200,000 more. It is true France was at war with Russia, but it appears from authentic statistics, from the War-office, that the total loss during the Russian war, both in the army and navy, and from all causes, was only 70,000.

Now let us look at another item of statistics—the number of marriages. This we shall find also decreasing.

In 1850 there were	297,900 marriages.	
1851	,,	286,884
1852	,,	281,460
1853	,,	280,689
1854	,,	270,906
1855	,,	212,773

So the decrease has been following almost a geometrical progression. In 1855, there were 85,127 marriages less than in 1850.

There cannot be any doubt that an increase in the population of a country is a positive element of prosperity, provided the supply of food increases in the same ratio; without that indispensable condition, it is a positive evil. Epidemics and emigration must re-rstablish the balance, or else the nation must exhaust its financial resources in the purchase of food from foreign countries. Therefore, increase of population is not always a sign of prosperity, and it can be an immediate cause of ruin. If population were to remain at a stand-still, and the resources of the country were to go on increasing, so that the means of each individual should benefit by that increase, this stand-still would be an immense benefit. But statistical science tells us that such positions are merely impossible. For, on the one hand, an abnormal increase of population, without a corresponding increase in the supply of food, is sure to lead to fearful mortality and misery, which, by diminishing the number of marriages and births, soon bring down the number of the inhabitants within the limits of the supply of food; and, on the other hand, the tendency of the human race to multiply itself is so energetic, that, in times of prosperity, that is, when food is cheap and abundant, it requires only 25 years to double its numbers. Therefore, those who might argue that, although the population of France may not be increasing, yet her resources are being rapidly developed, and her material prosperity is the more securely progressing as it is shared by fewer individuals, fall into a grave error, for I will presently show that French agriculture does not produce a sufficient supply of food even for the stationary, if not decreasing, population of France, and I will also prove that her material prosperity, such as it is manifested by great enterprise, and useful public works, bears no comparison with that of her neighbours, with perhaps the exception of Spain and some petty Italian States. But some will no doubt point to the magnificence of Paris, the gigantic embellishments which have been achieved of late years; others may refer to the net of railroads which is being steadily carried all over the country, &c.

Now, let us examine those two symptoms of prosperity. A very few considerations will suffice to show how deceitful they are.

Paris, it is true, has been greatly embellished; its population has increased in a few years by at least 300,000 inhabitants; immense sums of money have been expended in pulling down its narrow streets and rebuilding others; in erecting palaces; making fairy-like parks, and public gardens, &c., but at whose expense? The reply is a forcible one—at the expense of agriculture. The 300,000 additional inhabitants chiefly consist of mechanics and labourers removed from the country. In 1856 alone, the number of labourers, principally masons, who left the department of La Creuse exceeded 50,000, the total population being 287,000. This wholesale emigration represented the sixth part of the inhabitants, and the able-bodied proportion being about 1 to 6, it follows that nearly the whole valid portion of the inhabitants of that department emigrated *en masse*. In the provinces of La Marche and Limousin there are now scarcely any able-bodied men left, and the cultivation of the soil is literally suspended. Add to this centralisation of highly-remunerated labour upon one single part of France, the 500,000 able-bodied men which conscription takes every year to renew the ranks of the army, and you will easily realise the deficiency of agricultural labour that must ensue throughout the land. Then, what an amount of treasure lavished upon Paris alone! whereas so many parts of France are still almost inaccessible from want of agricultural roads; if a due proportion of that money was spent in draining, making roads, and other useful improvements, there might be less splendour, perhaps, but there would be a far greater degree of substantial wealth and prosperity. To give an idea of the enormous disproportion of expenditure for public works in Paris, as compared with the whole of France, it will suffice to state that, in 1855, the whole amount of public money spent in improvements throughout the country was £84,080,000, out of which Paris alone absorbed the enormous sum of £35,080,000, nearly the half of the whole amount. Now about railways. If we examine the relative proportion of miles opened for traffic, we find that in England there are proportionately ten times more than in France. Belgium and Germany exhibit also a large superiority in that respect. But as a last proof that the standstill of the population in France is not attended by an increase of wealth, and especially agricultural wealth, let us examine the official return of food importations for the year 1856, and we shall see whether, with her reduced population, France is able to find in its agricultural resources a sufficient supply of food. But before I give the official figures, allow me to remind you that the population of France is only to that of England as 68 is to 100, whereas her home production of food is only one-third of that in England, Belgium, and Holland, two-thirds of what it is in Germany and Lombardy, and it hardly comes on a par with the less populated and worse governed portions of Europe, such as the Italian peninsula, Spain, and Portugal. The importations of agricultural produce in 1856 were as follows:—

Cereals	£12,120,000
Rice	1,400,000
Dry vegetables, and other farinaceous food	280,000
Cattle	2,240,000
Meat, fresh and salted	320,000
Butter and cheese	440,000
Wine, spirits, and beer	2,160,000
Table fruit	720,000
Olive oil	1,000,000
Silk	9,880,000
Total	£30,560,000

This is important, as it expresses the exact deficiency in the agricultural produce of France for a whole year, and constitutes, after all, the most accurate agricultural statistics. Only calculate what a difference the production of food can make in the wealth of a country; supposing French agriculture to be as prosperous as it is in

England, in Belgium, or in Holland, instead of having to pay foreigners 30 millions of pounds a year, France would be enabled to export double that amount, so that she would realize an annual profit of nearly 100 millions sterling!

This calculation, which gives the measure of what French agriculture could do, alas! gives also that of its shortcomings and poverty. Let us now examine the actual causes which contribute, directly and indirectly to this lamentable inferiority.

Among these causes, the division of property has often been cited as one of the most destructive. For my part, I believe the evil influence of that system is more apparent than real. In the first place, property in France is far less divided in reality than appears from the number of property-tax schedules. The number of schedules, or as they are called, *cotes foncières*, do not represent the number of land proprietors, because there is a schedule for every portion of land owned in a special district. For instance, I own a property in the neighbourhood of Lisieux, in Normandy, which happens to be situated upon the limits of three districts, and I am returned in three schedules for the same estate. In the second place, the average of children in French families does not exceed two and a-half, so matrimonial alliances, especially with the dowry system, go far to reconstitute properties divided by succession. In many cases, an equivalent in money is given to daughters, so the landed property remains to the son. Where there are several heirs to a property, it is also frequently sold and the money divided; such land is either bought whole, and, of course, suffers no division, or, more frequently, is bought by a neighbouring proprietor, near whose property it lies, and thus increases other estates, producing the very reverse of division.

Of course, I do not attempt to deny the advantages of large estates, as regards agricultural prosperity, but I do not think that in France they would be attended with the same advantages as in this country. Extreme division of holdings is certainly a great evil, and a fatal obstacle to agricultural progress, but with the lack of capital among French agriculturists, moderate-sized farms are a positive advantage. With the limited means at their command, French farmers can hardly cultivate what they hold; how could they be expected to succeed better with more extensive holdings? With no drainage, few cattle, no artificial manure, scarcely any sheep, except in districts where little corn is grown, and no capital, farming on a large scale is wholly out of the question. I have just mentioned drainage, cattle, sheep, and artificial manure; let us examine how French agriculture is situated in respect to these life springs of agricultural prosperity.

There are in France no less than 30,000,000 acres that want drainage, and out of that immense surface there are only 86,000 now drained, 20,000 of which belong to one single department, that of Seine and Marne, where some of the best farming in Europe is to be seen.

France possesses about the same number of sheep as England, but the difference of size, weight, early maturity, and quantity of wool, even setting aside the difference in the surface of both countries, establishes an immense superiority for England, which besides breeds and feeds twice as many heads of cattle per acre. As regards artificial manures, I will only state that out of 223,000 tons of guano that were shipped from the Chincha Islands in 1854, 113,000 came to England, 98,000 went to America, and only 5,688 were landed in France. The absurd navigation laws, which allow guano to come to France only in French bottoms must, as a natural result, enhance the price of that precious manure, so that it is dearer in France than any where else. Superphosphate is almost unknown, the only artificial manure employed in any considerable quantities being animal black and poudrette.

The manufacture of agricultural implements, which in this country has reached such gigantic proportions, scarcely exists as an industry in France. The rude implements used by the peasantry are generally manufactured by village mechanics, from old and unimproved patterns, handed down from generation to generation. The importation of modern implements from England and Belgium, although the duty has been greatly reduced, is next to impossible, from the vexatious formalities exacted by the Custom authorities. Besides, improved agricultural machinery must always remain out of the reach of the French farmer, not only from the almost impossibility of importing it from other countries, but especially from the high price of iron, which is kept up by protective duties to the great detriment of agriculture. The consequence is, that land in France is ill-cultivated, ill-cleansed, ill-sown, ill-reaped, and overrun with weeds, which fester undisturbed amidst meagre crops, one-third of which they destroy by robbing them of their nutriment.

Such, unfortunately, is the prevalent and general state of agriculture in France—and to this state must be ascribed the cause of that deficiency in the production of food which exercises so fatal an influence over the population and prosperity of the country. But I should render myself guilty of partiality and injustice were I to omit to say that in the midst of that degeneracy, there are bright spots, significant symptoms of revival, which bid us hope for a rapid improvement. The late political revolutions have caused many eminent men, whom public duties and honours had called to the capital, to withdraw to the peaceful and soothing scenes of their rural abodes, seeking that *dulce otium* so beautifully sung by Horace in one of his happiest odes. Others, keeping aloof from a government with which they have not only no sympathy, but for which they actually entertain a hostile feeling, have passively withdrawn from active interference in political interests. These men have soon freed themselves from the hold which the gaieties of the Paris world, had once upon their habits and tastes, and, quietly settled in their chateaux, they have applied to the improvement of their patrimony, and the advancement of agricultural progress within the sphere of their influence, the enlightened energies of their spirit, and the savings which a retired and simple country life, enabled them to realise upon their incomes. Ever since the revolution of 1830 this movement has steadily set in. In 1848, that period of excitement, by stirring old party expectations and sympathies, mouldering but not extinguished, checked it for a time, but since the establishment of the empire, all those who have escaped from the fever of speculation or ambition have once more returned to the fields, and the effect has been that the old French society of the Faubourg St. Germain is almost extinct in Paris; in its stead there has sprung up a society of monied men, wealthy to-day, ruined to-morrow, who have brought into the very constitution of their social circles, those reckless and loose principles which operate with an immediate action upon the raising up and the downfall of the fabric of their fortunes. It is a well-known fact that within a radius of 20 miles around Paris, the landed property changes hands every twenty years.

Unfortunately, French landed proprietors as a class are poor in capital, and this disadvantage especially falls upon those who devote themselves to agriculture; hence the slow pace of improvement. This drawback is still increased by the singular notion, that every shilling spent in improvements upon the land is utterly lost. This notion is pretty general through all classes of society in France. It is an undisputed axiom among landed proprietors, that landed property does not return them more than 3 per cent., which is pretty correct, if we consider it only as an investment for capital; but they do not consider that, to that low rate of interest, must of course be added the profits realised by the farmer. It is very obvious that if we consider agriculture as an industrial interest, which it really is, we must allow that it requires a certain outlay, like other manufactures, before it can bring

a return. Experience tells us, that there is no raw material that yields so bountiful a reward as land, when money is liberally and judiciously spent upon its improvement. But, owing to prejudices on the one hand, and the want of capital on the other, the efforts hitherto attempted have been timid, grudgingly made, and, in too many instances, abortive, for want of sufficiency. Nevertheless, the more general attention of land proprietors to their estates, the growing taste for agricultural pursuits among them, is one of the happiest symptoms of progress, because it constitutes a practical incentive to that progress among the truly agricultural class, I mean the peasantry, by setting them an example, the only argument that has any hold upon their understanding.

The class of English farmers cannot be said to exist in France. With some few exceptions, in the northern districts and around Paris, the peasantry is not above the class of labourers in England, and by no means so intelligent. Their long possession of the soil, their isolated position which leaves them outside that general movement of civilization only felt within the sphere of centralization, when centralization exists in a community to so great an extent as it does in France, and the narrow limits of their ambition, have hitherto smothered every germ of improvement in their minds or in their material position. Having no capital, they can barely obtain from their little holding enough to pay the rent, and eke out a coarse subsistence for their families. With the surplus of the rye, barley, or buck wheat, which have not been sold to pay the landlord, they knead the dark loaf which forms their staple food; with the wool of their scanty flocks they spin and weave their rude garments; meat they scarcely ever taste. Poverty and the vicissitudes of produce from a soil so ill cultivated, have necessarily engendered among them penurious and miserly habits. What money can be saved from unheard of privations is hoarded up and concealed in old cupboards, and lies totally unproductive. Not even the faintest glimmer of modern commercial policy has yet penetrated into that class, and, generally speaking, they have no idea of credit or bills of exchange. They never avail themselves of the machinery of banks; all their transactions are in hard cash, and not many years ago they did not even know gold. I perfectly remember a farmer, a perfect stranger to me, stopping me once in a country road to ask me if I knew gold, and showing me a few gold coins he had just received in payment at the neighbouring town, evidently with very serious misgivings as to their value. There cannot be any doubt that, even in the present day, there is a vast amount of bullion treasure hidden in France—buried in hiding-places. The singularly successful loans effected by the emperor, at the time of the Crimean war, when, in a few days, and from the lower classes, twenty times the amount wanted was filled up, is a sufficient proof of that lamentable fact. And yet there cannot be any doubt that, in the French peasantry lies the strength of the country. As a body, they are sound and staunch; their vices are no doubt the result of the neglect in which the system of centralization has abandoned them; but their virtues are untouched, and those virtues are of the same stamp as those of the forefathers of our degenerate modern societies—those of the early Romans, who handled, with the most natural transition, the plough and the sword, and who wrought, by their stern virtues, the foundation of that gigantic power which an effeminate posterity let slip from their feeble grasp. The French peasantry are patient, sparing, religious, and highly moral. Conscriptions draw every year into the ranks of the French army at least 400,000 of their robust sons, and a thousand European battle-fields, reddened with their generous blood, have proclaimed, in triumphant and glorious records, how they can die and conquer. Once get the thin edge of progress into their traditions; let a gleam of enlightenment kindle their hard and miserable career with a beam of sunshine; let a little more comfort cheer their homes; let a more extensive range of ambition widen the sphere of their activity; let a little more capital improve their land; let their commons be divided or alienated to spirited and enterprising agriculturists; let their breeds of cattle be improved by the infusion of better blood; let banks of credit introduce into their trading habits less cumbrous modes of dealing; let them understand the use and value of money, which derives life and production only from quick circulation; let a rational education, suited to their wants and requirements, burst open the stolid crust of blind routine that enslaves them, and the French nation will rise great and powerful from inherent and intrinsic worth and strength, for she possesses in her peasantry, which is the bulk of the population, the moral stuff wherewith great and glorious communities are formed.

The higher classes in France, owing to the absolute sway of the government, which buys and sells them with honours, lucrative posts, and a boundless patronage, have little or no influence; those that are honest are generally poor and inactive. The monied class, and what is called the bourgeoisie or trading class, are rotten to the core; they have no religious creed nor principle. Sensuality and selfishness are the two motive powers of their thoughts and actions, the rankest infidelity unbridles in them the brutish appetites of human nature; and the riches they acquire only serve to pander to their vices. Alone, the rural population has preserved those primitive virtues of innocence and morality which are the real strength of a nation, and without which it must decline and fall, and even totally disappear from among the ranks of the human race.

But, I may be asked, has the French government done nothing to revive agriculture? There is a minister of agriculture; there is a large and influential staff of agricultural inspectors; there are innumerable government model farms, agricultural colleges, breeding establishments, where the best English cattle are kept; there are shows, both local and general; there have even been some called universal and international. We have heard of a vote of 4,000,000 sterling for drainage; there is a bank of *crédit foncier;* very large sums of money are spent from the consolidated funds and from local resources, in liberal prizes and encouragement; surely all these must have exerted a considerable influence upon French agriculture, and given an extraordinary impetus to its progress.

We have all heard of—and some of my audience, perhaps, have seen—a strange and somewhat awful experiment performed by means of a galvanic pile upon a corpse. A wire is put in communication with the spinal marrow, and life, movement, and action are restored to the muscles; the corpse will stand erect, open its eyes, move its arms and legs; its livid lips will quiver as if they were going to speak, and to all appearances death has been conquered, and the corpse lives; but only interrupt the mysterious current from the pile, and the lustre of the eyes will vanish, the arm will fall inert; the jaw will hang, the eyelids will close, and the ghastly corpse will fall to the ground, once more a helpless mass, on the verge of decomposition. In like manner the action of the French Government props up a show of activity, a show of vitality, in the French agricultural interest, but it exists only on the surface. Who are those who exhibit at the shows? they are only a few amateur fancy farmers, and the specimens they exhibit very often constitute the totality of the stock they have on their farm, and are by no means a sample of the agriculture of their districts. The farmers, with very few exceptions, are not only not exhibitors, but not even visitors. The schools have been productive of very little good. As farms, they have been lamentable failures, and the peasants point to them as instances of the folly of modern ideas; in fact they do not pay, and as model farms, they ought to pay. The Crédit Foncier is only a loan establishment upon mortgages, a gigantic pawnbroker's shop, too intricate and formal in its working to

be of any real utility. As to the grant of 4,000,000 sterling for drainage purposes, it exists only upon paper, not a sou of it has yet been applied, or I verily believe even asked for. The fact is, that the government interferes too much with agriculture; they assume too absolutely the guidance of progress, but they only turn within a vicious circle, fancying they go a great pace and accomplish a long journey, when, in reality, they only turn within a ring. Nothing is left to private enterprise, and, on the contrary, if anything be attempted from private initiative it is immediately snubbed and put down. The result is, that so much dependence is placed upon government initiative, that, wherever the immediate action of the state is not exerted, no institution, no society, no common interest can arise from local necessities and wants, and that individual energy which local necessities invariably start into existence, when the action of society is unfettered and independent, lies dormant and inactive, because a universal state tutelage enthrals the whole community in indolence and careless indifference. All this show of vitality is therefore a sham, the result of a temporary galvanic current. Let the state cease to interfere, and all this brilliant activity will vanish, and the poor agriculture of France will appear what it really is, an inert corpse, scarcely retaining the spark of life. And how can it be otherwise? It bears the huge incubus of a property-tax amounting to 20 per cent. of its gross produce. All the raw materials necessary to its operations are saddled with a heavy import duty, just to favour a few ironmasters and manufacturers, who fatten upon this exclusive and partial protection. In order to favour navigation, guano is made dearer than anywhere else; salt is the object of a monopoly which renders its use an impossibility, although a portion of the impost is remitted for agricultural purposes, yet, the formalities to go through, and the expense of rendering it unfit for any other use, are such, that it would be cheaper to pay the full price of the monopoly. Agricultural implements cannot be obtained, except at a ruinous expense. Such, then, are the stumbling-blocks which a rational government ought to remove; and these once removed, private enterprise and institutions ought to be encouraged, and the dangerous interference of government gradually withdrawn. For the experience of history, particularly in England, convinces us that, the less the government of a country interferes with the independence of commercial and industrial interests, the more they prosper, and the firmer is the base upon which their structure is built.

But, however desirable independence of individual action may be, generally speaking, there is one point in which the direct influence of the State may be brought to bear with great advantage, and that is—the application of the power of public means to the realization of great enterprises, entailing, by their success, a great amount of public advantage. In France, such a course is still more necessary than in any other country, because, as I have stated, the people are accustomed to trust to the Government's action for almost every public and local interest. I principally allude to the draining, enclosure, and cultivation of the commons and Government lands, which, in their present undrained state, are a source of misery, pestilence, and sloth, and which, by means of improvements by no means difficult of execution, might soon be metamorphosed, as by the touch of a magic wand, into plains of unlimited richness and fertility.

The French emperor seems at last to have become aware that, without a greatly improved agriculture, the country he governs cannot become truly powerful, truly great, and truly prosperous, and, which is of vast importance to himself and his dynasty, truly tranquillised and internally settled. He has lately applied to the revival of French agriculture the energetic activity of his mind, and, impatient of the obstacles of routine and official formalities, he is striving, by personal example, to give a salutary impulse to the whole ponderous and musty fabric. He has purchased whole tracts of waste lands in various parts of the empire, selecting the poorest and the most desolate. His will and his money have trampled down every difficulty, and started fields and farmsteads into existence, where but yesterday nothing was seen but pestilential swamps and barren sands. Having become a farmer, let us hope he will soon feel all the disadvantages under which the farming industry of France is groaning, from restrictive and unfair commercial laws which his power can repeal. Should this be the only good record of his reign, it will suffice to hand down his name to posterity as a benefactor to his country.

And now, in conclusion, allow me, as a matter of duty, to pay a homage in which men of all nations and all classes will readily join, to those eminent Frenchmen who by their researches and profound studies have cast such a vivid light upon the hidden mysteries of nature, especially those of vegetable physiology, and thereby have accomplished so great a progress in the agriculture of the whole world. When I name such men as Dombasle, Gasparin, Payen, and Boussingault, you will admit that, if there is a dark side to French agriculture, it has also a most brilliant obverse. With such names inscribed upon her banner—with such leaders as her sovereign, and spirited landed proprietors—and with such a phalanx as her peasantry, surely French agriculture cannot perish or remain at a stand-still. Her steady tramp is already heard on the arduous path of progress, and, with the indomitable courage and endurance of her sons, and the inexhaustible advantages of her clime, she shall achieve the victory.

DISCUSSION.

Mr. S. Sidney said he rejoiced in the circumstances which had induced Monsieur de la Trehonnais to take up his residence in this country, as those interested in agriculture had thus the advantage of listening to his eloquent speeches at their great agricultural meetings, as well as to the very able paper with which they had been favoured that evening. M. de la Trehonnais had drawn a vivid picture of the French peasantry; men labouring industriously day by day throughout the year; living upon the plainest food, and but seldom tasting meat, and yet, in spite of all these sacrifices, they scarcely succeeded in producing a sufficient supply of food to meet the general wants of the nation. That picture scarcely sufficed to give an idea of the agricultural districts of France. One might travel in that country for hundreds of miles—avoiding the large towns—and one would only meet with people of the humblest class. There were but few properties to be seen which could bear comparison with one of the 250 acre farms in this country. The country was dotted over with villages, in which was to be found scarcely a single house of importance except the residence of the government official or the police officer. The general condition of the French agricultural community was that of a large collection of peasant proprietors, with scarcely any capital, cultivating the soil with the most praiseworthy industry but with the smallest amount of skill. The result of this state of things, was, as had been truly represented by M. de la Trehonnais, that agriculture, instead of progressing, had retrograded. Those who had read Arthur Young's description of France before the great revolution could not fail to come to this conclusion. French agriculture laboured under the disadvantages of fiscal laws which seemed to be based upon the principle of discouraging all importation, under the idea that exportation could be carried on to a large extent without involving the necessity of importing anything. He could not help observing that all writers upon French agriculture avoided touching upon the point which he had always

regarded as the greatest impediment in the way of agricultural progress in France; that was the division of landed property. In regarding the condition of agriculture in France, they must take into consideration the fact, that about 60 years ago, a very large portion of land was confiscated and sold at a very cheap rate, and fell into the hands of the peasant cultivators of the soil. Let them conceive what would be the condition of things in this country in the present day, if within a short period the farmers had had an opportunity of acquiring large tracts of land at one-third of its value. But, notwithstanding this, agriculture had declined in the way described by M. de la Trehonnais; and he (Mr. Sidney) thought that this was owing, in a great degree, to the state of the law in France, with respect to the division of property, which he submitted was such as to prevent the development of the agricultural resources of the country. The law was that upon the death of the father the land was to be equally divided amongst the children or successors with the exception of one-third. The consequence of that system was that the land was burdened with mortgages, and the agricultural families were occupied in arranging, with the skill of rural Talleyrands, how their plots of land might be kept together in sufficient extent for cultivation. He believed it would be found that 25 acres was beyond the average extent of occupations in France. M. de la Trehonnais had correctly stated that in that country farmers were not to be found like those in England. This he (Mr. Sidney) believed was to be traced to the system of compulsory division of property. In England the landed proprietor provided the necessary farm buildings on his estate, and, in many cases, also furnished the capital for the efficient drainage of the land. It was thus prepared for the tenant farmer, who brought his industry, skill, and intelligence to bear upon it. But the system in France was totally different. In order to have wealthy landlords, they must have comparatively rich tenants. Arthur Young had stated that good farming implied much labour and much capital, but in the French system they had neither of these. Still it was impossible to mix with the working classes of France without being struck with the energy and skill they displayed in their business pursuits, and they were driven into the large towns as being the only real fields for enterprise. In this country a man who invested his money in land, inherited the traditions of the landowner. He was satisfied with a moderate interest for his money. He wished to keep the land for his successors, and hence his desire was to see a flourishing tenantry around him. He did not regard the money expended as lost, although it might not return interest for seven or ten years, because he considered it as an investment for his posterity. But, on the other hand, it was stated that in France the land changed ownership, upon the average, every 20 years. The great landed proprietors of England, men of large capital, had devoted their attention to the improvement of their estates, with the best results to agriculture. He might point to such men as the Bedfords, the Spencers, the Yarboroughs, and a host of others. Those were the men who had expended vast sums upon their estates in providing the necessary materials for the tenants to work upon, and who had done so much for the agriculture of the country. Their successors would inherit the traditions of their fathers, and thus the march of improvement would steadily continue.

Mr. J. J. MECHI could not allow that opportunity to pass without expressing his warm admiration at the comprehensive manner in which this great subject had been treated by his friend, M. de la Trehonnais. He (Mr. Mechi) would hardly venture an opinion as to the causes of the present condition of French agriculture, but he believed that the influences which had tended to injure agriculture in Ireland applied also to France—namely, non-residence, and the absence of a poor-law system. Political influences, no doubt, had something to do with the matter. In England the possession of land gave a political status, which rendered that description of investment a favourite one. At the same time he (Mr. Mechi) was not competent to give an opinion as to whether such a system could be introduced in France. With regard to roads, he did not know whether the parishes were indictable for neglect in not keeping them in proper repair. There were many practical questions connected with French agriculture into which he would not enter. It must be admitted that the French stood foremost in the ranks of art and science, but he agreed with M. de la Trehonnais that the system of centralisation in France had gone very far to prevent the development of those powers which, as a people, they were known to possess. He was glad to hear that at one period, at least, agriculture was prosperous in France. Any disturbance of the security of property would seriously affect agricultural interests, and one great cause of the progress in this country was the perfect reliance that was placed on our laws to protect the property of every individual, and the security which was universally felt that any capital invested in improvements in land was safe, however distant the prospect of remuneration.

Mr. RAMSAY addressed the meeting at some length upon the general topics treated of in the paper. He could have wished that less space had been devoted to the political economy of the question and that a larger share of attention had been given to the comparison of the agricultural state of the two countries. He agreed with the preceding speaker that much of the evil in connection with agriculture in France was attributable to the absence of the law of primogeniture; and so long as that was wanting they could not look for any great improvement in the agricultural condition of the country. He instituted a comparison between the present state of things in France, in connection with the landed interest, and that which existed in Ireland previous to the operation of the Encumbered Estates Act. Previous to that time, the people actually persisted in starving themselves by the cultivation of potatoes as the staple food, but when the land changed hands, the cultivation of superior crops was introduced, which afforded to the people a higher class of food and better remuneration for their labour. Some such system was required in France before they could look for any marked improvement in the agriculture of that country.

Mr. G. F. WILSON, F.R.S., said, as it was probable some present would wish to look a little farther into the first part of this interesting subject, with reference to the state of agriculture in the 16th century, he would mention that in a book entitled "The Life of Palissy the Potter," written during the time of the Huguenot persecution, some highly interesting remarks, suggestive of improvements in agriculture, would be found. In some material points, they coincided with the improvements that Mr. Mechi and others had urged with so much earnestness and ability in these later days.

Mr. THOMAS SCOTT remarked that the agriculture of France had a peculiar character of its own, and he had hoped that this paper, coming from an eminent practical agriculturist, would have described in detail the development of that peculiar system which France possessed. M. de la Trehonnais concluded his paper by stating that the government was now interfering in agricultural matters, and added the sound political maxim that trade thrived best apart from governmental interference. Nevertheless, for his own part, he thought much was due to the great man who now ruled France, for the steps he had recently taken in reference to the agriculture of that country. He was a man imbued with our English system—not only of agriculture, but also of political economy; and he believed it was well known that the Emperor had a strong desire to relax the stringent fiscal regulations which interfered so much with the prosperity of the commerce of France as well as the advancement of its agricultural interests. But in the

peculiar position in which he was placed, the question arose whether he could do so with safety. The Emperor had promoted agriculture by the exhibitions which had taken place under his auspices, and by the government grant for drainage purposes. Under these circumstances he could not go with M. de la Trehonnais to the extent of saying that agriculture in France should be still left to its own resources. The late agricultural movements in France had had a favourable effect; but that the Emperor would, in his generation, be able to effect the reform of the entire political as well as agricultural system of the country he thought was extremely chimerical, and to try all at once to engraft our own improvements upon a people who had at present no knowledge of those improvements, and who were, for the most part, ignorant of the implements used in this country, would be altogether out of the question. The shows of cattle, the importation of English implements of agriculture, and the great example of cultivating model farms, which the present Emperor of France had so worthily set, could not but be beneficial to the agriculture of France, which, he thought, must be regarded as the backbone of its national prosperity.

Mr. ELLIOTT thought that M. de la Trehonnais, in his desire to treat this subject with the strictest impartiality, had scarcely done justice to his countrymen. He thought he had not fairly shown the present physical condition of the French people, as compared with 30 or 40 years ago. The facts as to the diminution of births and marriages, as compared with the increase stated to have occurred in deaths, he thought did not quite prove the conclusions at which M. de la Trehonnais had arrived. Without any information as to the average length of life, they could not arrive at a just conclusion, for a mere decrease of births and marriages, and an increase in the number of deaths, was not inconsistent with the improved condition of a people. He thought a fair examination into the social condition of France, would show that with a diminution in the number of births, and therefore a diminution of its population, there had been a very marked increase in the quantity of food produced in the country. It might not be as delightful a state of things as we had in this country, where we had an enormous increase of population co-existing with the increase in the production of food and the other material elements of well-doing; but it might happen that the state of France was, apart from political disturbing causes, more safely progressing than our own. The excessive development of population and industry in this country might carry us a little beyond the element of safety. Mr. Elliott proceeded to remark upon the great improvement he had noticed, as the result of close observation, in the *physique* of the French people as compared with former periods. He considered that this had been improved during the last 20 years, to the extent of 25 to 30 per cent. He had particularly noticed this in Paris, and he believed that the same might be said as to the inhabitants of the provinces. But whatever might be the feeling of rivalry between the two countries, it was a great gratification to find, notwithstanding all the unfortunate circumstances in which France had been placed, that there was an immense improvement apparent in the physical condition of the people. They were much better fed and better clothed than formerly, and far from lamenting over the circumstance of the diminution of births, he thought that was one of the means by which the French people would adjust the population to the quantity of food they produced.

Mr. PEARSALL remarked that the extensive colonization now going on amongst the French people was a circumstance worthy of consideration in the discussion of this subject. It sometimes occurred that, in Algeria alone, there were 80,000 troops. The climate was the most beautiful that could be imagined, and the French were invited to colonise there.

Mr. WILLIAM FISHER HOBBS said he had been highly interested by the paper read by his excellent friend, M. de la Tréhonnais. He thought that gentleman, like too many others of his countrymen, out of compliment to the English farmers, had placed the agriculture of France below its true merits. During the last three years his experience and observation of French agriculture had been somewhat considerable; and he must say that the remark which had fallen from previous speakers had placed the agriculture of France in a very unfair position, according to his opinion of it. Indeed, Englishmen visiting France usually only took a very superficial view of the state of the country, and had rarely much opportunity of close observation. Some had also argued upon the extent of the productions of France from the agricultural statistics of that country. He begged to say that they formed no criterion as to the actual produce of the soil. The agriculturist of France was taxed much more heavily than the agriculturist of England, and there were so many schedules used in the collection of the statistics that he did not believe they exhibited the real produce of the land. It had been stated that the character of the agriculture of the country was to be judged from the fact that the land changed ownership every 20 years; in England it was calculated that the land changed hands every 30 years, therefore he did not think that fact went for much. From what he had himself seen of the agriculture of France, there were farms of 800 acres, within 50 miles of Paris, which would bear comparison with any farms in any part of England or Scotland. In fact, he had seen as good practical farming in France as in England. With reference to the agricultural labourers of France, he need only go back to the great gathering at Paris in 1856, to show that in education, manners, and dress, the peasants of all the foreign nations there represented were very much in advance of those of the English peasant. He thought the remarks made were generally too disparaging to French agriculture, inasmuch as he believed that there was no leading feature of improvement in this country which was not speedily taken up in France. In this respect, therefore, he could not agree with M. de la Trehonnais. He believed the French government had done a vast amount of good for agriculture, and was still doing good, in the distribution over the country of superior breeds of stock for the purpose of propagation, in the establishment of agricultural exhibitions, and in the employment of agricultural machinery, and he had no doubt that country would in a short time reap the benefit of those measures.

The CHAIRMAN said, the time having arrived when the discussion—interesting as it was—must be brought to a close, it was now his pleasing duty to propose a vote of thanks to M. de la Trehonnais for the very interesting paper he had laid before them. Whether they regarded the matter of the paper or the language in which it had been clothed, he was sure they would all agree that it was a most admirable production. However much they might differ from M. de la Trehonnais as to the comparative merits of English and French agriculture, and the appearance of the English and French labourers—in spite of all those differences which naturally occurred when a body of men assembled to express their real opinions,—he was sure they would all agree that nothing more frank as an expression of opinion of the condition of his own country could have been presented by a foreign gentleman to an English audience. With regard to the existence of a class of peasant proprietors or peasant cultivators, that was a point of national importance quite equal to any question of fiscal regulations. Another subject to be regarded was the influence which a great manufacturing country exercised upon agriculture. What was it that had led to the agricultural pre-eminence of England? It was not the desire of men to spend money in the improvement of the land or the desire to cultivate land highly, but it was the

knowledge that the development of the productions of the land, where so large a proportion of the community were engaged in manufacturing pursuits would amply repay them for all their expenditure. He believed it was in this respect the agriculture of England and France differed, and notwithstanding what Mr. Hobbs had said as to farm cultivation, and in spite of all they saw on the borders of Flanders, which was as well cultivated as a country could be—yet any one who travelled through Brittany and Normandy as well as some other parts of France, would, in the present day, see that the cultivation was sadly inferior to that in this country. He had seen the plough drawn, not by one horse, or one bullock, but by the one cow that furnished the peasant with his only milk, and that was not an exceptional case; and, where that system prevailed, it was hopeless to look for agricultural excellence. He thought some of the remarks of M. de la Trehonnais had been a little misunderstood. He did not deny many merits on the part of the present ruler of France, but, on the contrary, took encouragement from his measures relative to agriculture. At the same time, M. de la Trehonnais was opposed to the system of centralization—that of the government taking on itself as large a share as possible of the operations of industry. It was to that cause that M. de la Trehonnais attributed a large portion of the defects at present attaching to the French agricultural system.

The vote of thanks having been passed,

M. de la Trehonnais acknowledged the compliment. He said he was aware that, in a paper confined to a few pages, there must be shortcomings in treating of so large a subject. He quite agreed with the Chairman in approving of the steps taken by the Emperor; the objections he had taken applied not to the Emperor, but to the system of Government. Allusion had been made to the marked physical improvement in the people of Paris. It was to be recollected that half the money for public works was expended in Paris alone, and that brought the artisans and mechanics into that city in great numbers, attracted by the higher rate of wages. But that was no index as to the condition of the people in the provinces. The same gentleman had spoken of the decrease of births as a subject not indicating the failing prosperity of a people. He (M. de la Trehonnais) begged to say that, not only had there been the diminution of births and increase of deaths which he had mentioned, but the average standard of life had also decreased. His friend, Mr. Hobbs, had eulogised the appearance of the French peasantry he saw at the Paris Agricultural Show. It might be that favourite servants were employed on that occasion, but they were not a fair sample of the labouring class in France. He had treated this subject not merely as an agriculturist, but as a political economist. Last summer he made the tour of the south of France, in order to enlighten himself on these subjects, and he had introduced his friend, Mr. Hobbs, to the farm of which he had spoken. He had stated in his paper that in the north of France and in Flanders the farming was as good as that in Great Britain, but those were isolated spots, and bore but a small proportion to the entire area of the cultivated lands of France.

The Secretary announced that on Wednesday evening next, the 24th inst., a paper by Mr. Thomas Allan, "On Electro-motive Machines," would be read.

On the table were exhibited two specimens of wood-carving, by Mr. William Bryer, an amateur.

SOUTH KENSINGTON MUSEUM.

During the week ending 13th March, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 2,894; on Monday and Tuesday, free evenings, 4,700. On the three Students' days (admission to the public 6d.), 770; one Students' evening, Wednesday, 306. Total 8,670.

Colonial Correspondence.

ON THE DESICCATION OF FUEL IN THE MANUFACTURE OF SUGAR.

Sir,—I beg leave to introduce through you, to the consideration of the Society of Arts, a few remarks on a subject of some importance to the tropical manufacture of sugar; I do not claim for them the same meed of approval with which the Society has already honoured some of my papers on kindred subjects, because they have not as yet been reduced to practice, still the data on which they are founded have been so well established, the inferences are apparently so plain, and the interests at stake of such serious gravity, that I am anxious the arrangements proposed should be submitted to a Committee of the Society, and, if considered practicable, either sanctioned by its approval or modified in such a manner as may subserve the interests of the planter.

The desiccation of the crushed cane is in itself a matter of serious moment, in whatever light it may be viewed, whether as regards the loss and inconvenience attendant on its deficiency as fuel or the anxiety and risk of storing it when abundant; its woody portion may be assumed as fully equal in weight to the crop of sugar shipped, say 300,000 tons, and as of this at least one quarter should always be on hand in the shape of dry fuel, ready stored for use, it may be easily supposed how its presence increases the anxiety of the sugar manufacturer, during the dry and windy months, when even the unreaped canes resemble tinder.

With a view of removing risk and increasing the supply of fuel of a better quality at a lower cost, I venture to submit as follows:—

It is well known to the practical planter, that after the juice has been expressed from the cane by the mill action, the crushed stem or megass, as it is locally styled, is transported, either by an endless web or otherwise, to a covered enclosure, megass-house, or logie, where it is carefully packed and stored, till dry enough to serve as fuel in evaporating the cane juice.

The vessels in which this evaporation is conducted are ranged on a line, for the most part extending variously from 40 to 60 feet in length, and it is found in practice that no fuel can conveniently replace the dried stem or megass, as it is not only produced on the spot, but its long lambent flame envelopes and plays round the evaporators more efficiently than that of any substitute; consequently its preservation is a matter of paramount importance to the planter; and as the quality of the sugar, *ceteris paribus*, depends much on its more or less perfect desiccation, he takes care to provide, so far as his means allow, ample accommodation for its storage. Accordingly, on large estates, the megass-house or logie costs occasionally as much as £1,000 or £1,500 sterling.

It is the pride and care of the planter that, at the close of the crop, his megass houses should be sufficiently stored with fuel to carry him through, at least, six weeks of the ensuing crop; this is the case on most well-conducted estates, but the supply of fuel, although desirable, and, indeed, indispensable, is a constant source of anxiety to the proprietor, and requires incessant vigilance to guard against careless or wilful incendiarism. Once on fire, the burning mass, perhaps some hundred feet in length, endangers or destroys, not only the neighbouring buildings, but, frequently, the growing canes for miles around. Nothing equals the horror of these conflagrations, except, perhaps, the desolation they leave behind. The fuel is also lost at the moment it becomes indispensable, because,

when the fire has passed through standing canes, it is necessary to reap them immediately, or the sugar which they would have otherwise furnished, is lost from the want of wherewithal to evaporate. No money payments can compensate for these losses, and, although the buildings may have been insured, the megass is not, and the immediate loss is aggravated by all the evils attendant on damp fuel, bad sugar, late hours, and discontented labourers.

If such accidents were inevitably connected with the manufacture of sugar, the planter might fold his hands with resignation when they occur; but they are not; and if you will favour me yet a little further with your attention, I shall, I hope, make it clear that it becomes his interest to obviate them as quickly as possible.

In proposing a remedy for such serious evils, it will be necessary, in the first place, to glance briefly at the composition of the sugar cane, and then to apply the data thus obtained to elucidate the desired practical result.

The sugar cane is generally considered as composed of 90 per cent. of juice, and 10 per cent. of woody fibre; this statement is not strictly correct, as it applies only to the merythyllis or internodular portions; the nodes themselves contain at least 17 per cent. of woody fibre, and, indeed, the whole cane, after maturity, very frequently becomes gradually dried up to perfect desiccation: therefore the proportion of fuel in the pressed cane must vary somewhat with the nature of the cane itself. The received opinion, however, that the sugar cane yields 10 per cent. of ligneous matter will form the basis of the present remarks, and, therefore, any variation in the dryness of the pressed cane will be considered as dependent on the varying power of the mills employed.

Let it be assumed, then, that the average quantity of juice expressed by cane mills is 65 per cent., (some mills, few in number, express more, but the average is certainly considerably lower,) then the refuse carried from the mill to the megass house contains not only 10 per cent. of lignine or woody fibre, but 25 per cent. of juice; what, then, becomes of this 25 per cent. of juice thus stored in the megass house or logie? Does it increase the amount of fuel in the crushed stem? Certainly not, for the sugar and water in the cane juice ferment and turn into acetic acid, which not only is in itself incombustible, but prevents combustion in other substances, and till it be fairly dried out the crushed stem is unfit for fuel, this process of drying requires months of storage, and even then is imperfect.

But again, it is found on the other hand, that when the megass, on leaving the mill, is dessicated, by being torn into shreds and exposed to the full ardour of the sun's rays, as is occasionally practised in the months of March and April, when there is any superfluity of labour, it may be used as fuel in the course of a few hours, and its superiority is evident to the most careless observer. Whence, then, this superiority to the ordinary fuel, which has been stored for months under cover? It is clearly due to the proportion of sugar contained in the crushed stem, which, instead of being allowed to ferment, has been converted by the dessicating action of the sun into a dried fuel of most unequivocal power. What has hitherto been exceptional, I would now propose as the rule, employing, instead of the sun's rays, some steadier and more manageable agent. It is not, perhaps, the best use to which the above-mentioned portion of sugar might be turned, but as in the present mode of manufacture its loss may be looked on as certain, the next best thing will be to utilise it on the acknowledged principle that nothing pays so well as refuse turned to profit. What, then, is the real value of this refuse, hitherto worse than thrown away? Is it sufficiently valuable to warrant the planter's incurring any expense in utilising, and if so, what will be his best plan to obtain the end in view?

It has been stated that 25 per cent. is the average amount of cane juice thus consigned to the megass house in the interstices of the cane stems, but cane juice from a matured plant contains 20 per cent. of crystallisable sugar—(to avoid discussion this per-centage is given as purely approximative—it varies, not only in the same colony, but often in the same field)—therefore, the quantity of sugar actually lost is equal to one-fourth of the whole sugar contained in ripe canes, and represents in its present forlorn state 5 per cent. of good fuel, which by simple precautions might be added to the 10 per cent. of woody fibre already known to exist in the crushed stems or megass. In other words, the quantity of available fuel for evaporating cane juice, or raising steam to crush the canes, might be increased 50 per cent. If the proportions given above be correct, and of that there can be little doubt, it follows, that even in an economical point of view, it would pay to dry the megass as it leaves the mill.

It should ever be borne in mind, while considering this matter, that the desideratum after all, is not so much preparing fuel, as getting rid of the megass houses, whose existence on every estate is a constant source of uneasiness and danger.

To attain this end, there will be no occasion to purchase any extra amount of fuel, if advantage be taken of the waste heat that at present escapes by the chimney. It is not many years since this hitherto lost heat has been applied to raise steam for the crushing power, from boilers hung on the flues beyond the coppers, between them and the chimney stalk. For this purpose the heat formerly wasted has been amply sufficient, and as the draught still enters the chimney at a temperature over 500° Fahrenheit, the remaining heat will, it is assumed, be capable of removing 15 per cent. of the 20 per cent. of moisture remaining in the crushed cane, and thus turning it at once into an available fuel, in other words, with 10lbs. of fuel to evaporate 65lbs. of water. If this be practicable under existing circumstances, it must, *à fortiori*, be more easily accomplished when the combustible has been increased by the 5lbs. additional of sugar which it has been shown the crushed cane stems contained when they left the mill.

It has been already stated that the stems of the canes on leaving the mill are carried continuously, on an endless web, to the megass house, or logie, there to be stored for future use. This endless web it is proposed still to retain, but to employ it in an altered direction, viz., from the mill to the stoke-hole of the furnace, enclosed in a low archway, constructed of whatever may be the most inexpensive materials attainable, such as the walls "en pisé," and the roof of sheet iron. Against the damp megass, as it advances at slow mill speed along the interior of this covered way, should be directed a current of heated air, drawn from the chimney, sufficient to lick up and carry to a suitable exit any amount of moisture it may encounter. The volume of heated air required for this purpose can only be ascertained experimentally, as considerable allowance must be made for the manner in which much of the moisture is retained among the interstices of the woody fibre, and the extent to which the latter has been laminated. In some powerful modern mills, the megass is turned out something like a web of cloth or paper, and might be as easily dried. The question of details will probably offer no insuperable difficulties to those accustomed to the practical management of heated air currents; it will therefore be unnecessary to offer here any opinion as to whether the air should be driven through the ashpit by a fanner, or taken heated from the end of the flue; in either case it would, if of efficient action, probably do away with the necessity of erecting, for the sake of draught, high chimnies in colonies where earthquakes occasionally happen.

I am, &c.,

HY. MITCHELL, M.D., Ph.D.

Trinidad, Feb. 22nd, 1858.

Home Correspondence.

MR. ASHWORTH'S PAPER ON COTTON.

SIR,—I did not leave the meeting of the Society of Arts, on Wednesday evening last, until the chairman, owing to the lateness of the hour, had declined to comment upon Mr. Ashworth's paper, or upon the subsequent discussion. I inferred, therefore, that the business of the evening had terminated, otherwise I should have been present, and have responded to the call of some members to reply to two questions proposed in Mr. Ashworth's closing remarks. The two questions were—"What number of Europeans have availed themselves of the Government rules to secure for themselves land in India in perpetuity;" and "What is the amount of the exports and imports from and to India?" Both these questions were intended, as Mr. Ashworth hoped, to weaken my statements; but in my absence he answered them himself, and proved the vagueness of the assumptions with respect to Indian facts which I had lamented in the discussion. He assumed that there were only from 300 to 400 European settlers in all India, but he might just as well have assumed any other number, as there are not any official returns on the subject. Mr. Ashworth inferred either that land was not obtainable, or that it was not worth getting; in either case forgetting that he had charged the Indian Government with refusing to grant land in perpetuity, and consequently Europeans could not become owners of the soil, a statement which I had proved unfounded in fact, by citing the Government rules for granting land. Mr. Ashworth answered his own question about exports from India, by "judging" them to be about twelve millions sterling, and added, "Did this indicate prosperity?" My reply to Mr. Ashworth's "judging" is, that the exports from India in 1834-5 were £7,993,420, and in 1855-6 they were £23,039,268, being an increase of 188 per cent. The imports in 1834-5 were £4,261,106, and in 1855-6 they were £13,947,657, an increase of 227 per cent., but leaving a balance of trade in favour of India in the first year of nearly four millions sterling, and in the last year of more than nine millions, which balance was paid in silver, and did not go out of India again; and Mr. Ashworth stated that in the last 27 years these payments had amounted to 150 millions sterling, and yet, in the same breath, he asks "does this indicate prosperity?" The fact is, the great balance of trade in favour of India is greatly owing to the manufacturers of Great Britain not adapting their products to the wants of the people of India. A small supply of woollens suffice for a people who, for some months in the year, would be glad to get rid of their own skins, if they could cool themselves by so doing. They do not want our wines, spirits, and beer, our hardware, glass, stationery, books, apparel, &c., &c., but India might take articles of clothing, turbans, women's sashes, loin cloths, sheets, and other articles of personal clothing, provided the manufacturers of England would send them out to India of the inflexible usage form, in length, breadth, fineness, marginal borders, tuft or fringe ends, &c., &c.; but this common-sense plan the manufacturers have never yet adopted, and the result has been the enormous balance of trade in favour of India, to be paid annually in silver. To enable the manufacturers to judge for themselves of the kind of apparel in use amongst 181 millions of people in India, the Court of Directors of the East India Company have extended their Museum at the India House, to embrace, for exhibition and examination, all the textile fabrics of India; and these are open, upon application at the India House, to the inspection of all manufacturers: and it will be their own fault if they do not take advantage of the opportunities offered to them. The Court, also, have made a collection of all the raw products of India, particularly of the fibrous kind, in the hope that new articles of import may be found amongst them, to the advantage of commerce and the manufacturing interests.

The New Museum is open to the public every Friday.

I am, &c.,

W. H. SYKES.

London, 15th March, 1858.

PUDDLED STEEL.

SIR,—I have read with much interest Mr. Clay's paper on puddled steel, and I have recently taken the opportunity (while in Liverpool on other business) to go to Messrs. Naylor's works, and see specimens of the rails, plates, rivets, &c., made of that material.

In considering the application of such a material to engineering purposes, the first idea which suggests itself is its employment in the case of rails subjected to wearing.

Let us assume the duration of rails on lines of heavy traffic at 10 years; of medium traffic at 20 years; of light branch traffic at 30 years. Taking the average price of rails at £8 per ton, and the cost of manufacture at £3 per ton, and putting aside the question of compound interest, which is never practically used, we have for the annual cost of renewal on lines of

Heavy traffic 6s. per ton,	per annum.	
Medium traffic 3s.	,,	,,
Light traffic 2s.	,,	,,

If we suppose the steel rails did not wear at all, then, taking money at 5 per cent., this commercial value, above that of common rails, would be on lines of

	s.		£.	
Heavy traffic.........	6 × 20	=	6	per ton.
Medium traffic......	3 × 20	=	3	,,
Light traffic.........	2 × 20	=	2	,,

And taking the cost of common rails at £8 per ton, the relative commercial value of rails, which would last for ever, would be in lines of

	£	£	£	
Heavy traffic.........	8 +	6 =	14	per ton.
Medium traffic......	8 +	3 =	11	,,
Light traffic.........	8 +	2 =	10	,,

But steel rails, though capable of great duration, will not last for ever; and, when worn out, are more expensive than iron to re-manufacture. Their price must, therefore be less than £14 per ton, to render their adoption advantageous even on lines of heavy traffic, and they must be produced at a still lower price to render them generally preferable to a well-made iron rail.

In the view of the cost above given nothing is allowed for the labour of taking out old rails and putting in the new, but the introduction of this item would affect the result very little.

In the case of rails for points and crossings the value of increased durability is much more important. Here, in addition to the cost of the rail and its re-manufacture, there are the maker's charges for cutting, bending, planing, &c., which amount to about £4 per ton. The duration of the best iron point and crossing rails in situations of large traffic is frequently not more than six months, and, in particular situations, even less than that.

With iron rails, used in points and crossings, therefore, there is an annual cost in renewal equal to $(3 + 4)\ 2 = £14$ per ton per annum. If the steel rails cost £15 per ton, and the manufacture into points and crossings £10 per ton, including cutting and planing, &c., and the duration, in a like situation, is four times that of common rails—then we have for the annual expense, including interest of money on the first cost:—for common point and crossing rails £14 8s. per ton per annum; steel rails £5 15s. per ton per annum.

Another application of this new material is for engineering structures, where strength is the object sought;

and for these purposes advantages of a very striking nature present themselves.

The steel produced by this process is stated to possess three times the tensile resistance of wrought-iron, and if its resistance to compression is in a like ratio, the results which arise are as follows:—

If w, l, d, and a, represent the weight, length, depth, and sectional area of a girder of iron $\frac{w\,l}{a\,d} = c$, a constant for similar forms of girder. If the girder is so constructed that equal portions of its length represent equal weights, and a load be equally distributed $= nl$, then, $\frac{(w + nl)\,l}{a\,d} = c$, a constant for similar forms of girder. In like manner if w', l', d', a', represent the weight, length, depth, and sectional area of a steel girder, $\frac{(w' + nl')\,l'}{a'\,d'} = c'$, the constant for steel in similar girders. But as steel is three times the strength of iron, while the specific gravities are nearly the same, we have for equal strengths $\frac{3\,(w + nl)\,l}{d\,a} = \frac{(w' + nl')\,l'}{d'\,a'}$. And in the case where the length and depth of the steel girders are the same as those of the iron, the weight of the steel girders would be $w' = \frac{w\,n\,l}{2\,w + 3\,n\,l}$.

Let us apply this to the case of the Menai tube. The weight of each of the principal tubes is 1,553 tons, the length is 460 feet, and the maximum load equals 1 ton per foot, then, $w' = \frac{1553 \times 460}{2 \times 1553 + 3 \times 460} = 160$ tons nearly. Thus a girder of steel, of like dimensions as wrought iron, excepting in the thickness of the plates, weighing 160 tons, would possess the same strength as the Menai tube in wrought iron, which weighs 1,553 tons. Some modifications in the details of construction would be required, especially to resist buckling at the top; but the broad feature of the result is as above stated.

Considering the difference in the expenses of the apparatus for floating and lifting the smaller weight, as compared with the larger, and the difference in the requisite strength of the piers, the introduction of wrought steel in girders of large dimensions is fraught with the most important results.

In making this statement it is, however, on the assumption that the compressive resistance bears the same proportion to the tensile as in wrought iron, and that the actual amounts of extension and compression within the limits of elasticity are not such as to cause undue deflection.

A carefully-conducted series of experiments should be made to ascertain the following properties of puddled steel in addition to the tensile strength, namely,—

The ultimate compressive strength.
The limits of elasticity for compression.
The limits of elasticity for extension.
The actual amount of extension.
The actual amount of compression.
The resistance to buckling.

Should these several properties be found, as is indeed probable, to bear a similar ratio to the tensile resistance as in wrought iron, the employment of wrought steel for large engineering structures (such as are now demanded for crossing some of the large rivers in India and Russia) promises to form an era in engineering quite as important as that of late years arising from the introduction of wrought iron. I am, &c.,

W. H. BARLOW.

19, Great George-street, Westminster, S.W., March 17.

THE ECLIPSE OF THE SUN.

Sir,—The following observations may interest your readers. They were noted down at the time, and were made on high ground, about 4 miles north of Tonbridge. I am, &c., H.

March 15, 1858.—Half-past 9 a.m.; wind nearly due north. One thermometer placed in the sun, aspect due south. A second in the shade, with a northerly aspect, and both exposed to the wind, at 2 ft. from the ground.

		Thermometer in Sun.	Do. in Shade.
9.30	Sun clear and shining brightly.	75°	49°
10.30		71°	49°
11.0		69°	50°
11.7	Clouds	65°	—
11.15	Clouds	62½°	—
11.30	Clear, light clouds	75°	49°
11.35		75°	—
11.45		71½°	49°
11.55		72½°	—
12.0		69½°	48½
	Sun partiallly obsured, but bright occasionally. Birds singing as in the early morning, wind moderated.		
12.15		60.5	48.0
	Birds singing; sheep feeding as usual.		
12.30	Wind for a few minutes apparently gone; but a fresh breeze soon arose, preceded by a gust, as in a storm; Sun quite obscured. Thermometer, 55.5° in sun, 48° in shade; birds still singing as before, sheep grazing. Lower wind, W.N.W., upper current, N.		
12.45	Darkness, that of a thunder-storm; birds continue singing, and sheep moving and grazing as usual. Wind N., Thermometer 53.5° in sun, 47° in shade.		
12.55		52.5°	45.5°
	Deficiency of light very sensible, but not so great as frequently occurs during a heavy storm—birds singing and sheep grazing as before.		
1 p.m.	Sun still invisible; there was no unnatural colour in the atmosphere; the darkness was not equal to that which frequently occurs during heavy storms.		
1.15	The sun was visible again, but I was unable to watch the increasing temperature.		

The difference of temperature due to the Eclipse, was, in the shade, 4.5°, from 50 to 45.5. In the sun, from 62.5°; the temperature at 11.15, when the sun had been obscured more or less by light clouds for three-quarters of an hour, to 52.5° or 10°.

The clouds not being so dense from 10.30 to 11.15, as from 11.30 to 1 p.m., it is hardly correct to attribute the 10° entirely to the Eclipse.

Proceedings of Institutions.

Lewes.—The report of the Mechanics' Institution for the past year, shows that the present number of members is 362; the increase during the year having been thirty-eight. The number of books (exclusive of those from Mudie's) issued from the library was 5,192. Seventeen lectures were delivered during the year. The soirée held on the 26th and 27th of February last was attended by 1,403 persons; the nett proceeds being £21 0s. 6d. This has been devoted to the refurnishing of the Reading-room, and the purchase of a microscope, the excess of cost of the microscope, £4, having been defrayed by voluntary contributions. The number of vols. added to the library during the year was 150. Several vols. have been replaced, and about 140 rebound. The vocal music class has continued its weekly meetings through the whole year, and the elementary class, with the exception of the summer quarter, its bi-weekly meeting.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Inst., 3. Prof. Huxley, "On Biology."
Architects, 8. Mr. James Blake, "Descriptive particulars and critical remarks on the Remains of the Abbey of Kilconnel, Ireland."
Geographical, 8½.

TUES. Royal Inst., 3. Prof. Huxley, "On Biology."
Civil Engineers, 8. Continued Discussion, "On Submerging and Repairing Submarine Telegraph Cables." And Mr. R. C. Despard, "On the Improvements of the River Lee Navigation; with remarks on Canals."
Med. and Chirurg., 8½.
Zoological, 9.
United Service Inst., 8½. Dr. Guy, "On the Report of the Commissioners appointed to inquire into the regulations affecting the Sanitary Condition of the Army, and especially the want of space."

WED. Royal Soc. Lit., 4½.
Meteorological, 7. I. Dr. Tripe, "Observations on the Meteorology and Mortality of London in 1857." II. Mr. Bollaert, F.R.G.S., "On the History of the Meteoric Iron of the Desert of Atacuma." III. Mr. Glaisher, "Meteorological Observations, &c., during the Solar Eclipse."
Society of Arts, 8. Mr. Thos. Allan, "On Electro-motive Machines."
Geological, 8. I. Mr. G. W. Ormerod, F.G.S., "On the Rock basins of Dartmoor." II. Mr. J. Leckenby, "On the Kelloways Rock of the Yorkshire Coast." III. Mr. J. C. Moore, F.R.S. and G.S., "On a Protrusion of Silurian Rock north of Ayrshire."
Archæological Asso., 8½.

THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
Geological Museum, Jermyn-street, 3. Professor Owen, "On Palæozoic and Triassic Reptiles." (3rd Lecture).
Royal Society Club, 6.
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.

FRI. Geological Museum, Jermyn-street, 3. Professor Owen, "On Palæozoic and Triassic Reptiles." (4th Lecture.)
United Service Inst., 3. Mr. J. Boucher, "On the Rise and Progress of the Minié Expansion System, including Remarks on the Rifle Projectiles of various countries."
Royal Inst., 8½. Rev. J. Barlow, "On the Mineral Candles and other products manufactured at Belmont."

SAT. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 23rd, 24th, 25th, and 26th February, 1858.

52. County Rates—Return.
62. Woods, Forests, and Land Revenues—Abstract Accounts.
78. Irish Reproductive Loan Fund—Account.
91. School Books (Ireland)—Return.
51. Sheriff Small Debt Courts (Scotland)—Return.
89. Court of Chancery—Return.
90. Divine Service (Army) Return.
93. Duchy of Cornwall—Account.
42. Poor Relief (Scotland)—Return (a corrected copy).
19. Bills—Grand Juries (Ireland).
24. ——— Government of India.
22. ——— Tenant's Compensation (Ireland).
25. ——— General Board of Health (Skipton).
Foreign Refugees—Copy of Despatch from Her Majesty's Ambassador at Paris.
China—Correspondence with the Chinese High Commissioner Yeh.

Delivered on 27th February, and 1st March, 1858.

85. Select Committees—Return.
92. Police (Scotland)—Rules and Regulations.
31. Property Tax and Population, &c.—Return.
97. Committee of Selection—Second Report.
Poor Relief (Scotland)—12th Report of the Board of Supervision.

SECOND SESSION, 1857.

306. Emigration (Australian Colonies)—Return.

Delivered on 2nd, 4th, 5th, 6th, 8th, 10th, 11th, and 12th March, 1858.

96. Revenue Departments—Estimates.
95. Excise Officers and Surveyors, &c., of Taxes (Scotland) Treasury Minutes.
100. New Zealand—Copy of Despatch.
101. Corn, &c., (Ireland)—Return.
102. East India (Annexation of Oude)—Return.
61. Works and Public Buildings—Abstract Accounts.
88. Hops—Account.
103. Quarantine—Return.
94. Public Monies—Copy of Treasury Minute.
99. Hudson's Bay Company—Return.
107. Aggravated Assaults (Metropolis)—Return.
72. East India (Education)—Copies of Correspondence.
98. Poor Rates and Pauperism—Return (A).
104. Immigrants and Liberated Africans—Return.
109. Hampton Court Palace and Kew Gardens—Return.
111. Spirits (Scotland)—Returns.
106. Quit Rents (Ireland)—Return.
108. Registered Electors—Return.
112. Kensington Gore Estate—Return.
Colonel Robert Frith—Copies of Papers and Correspondence.

SESSION (SECOND), 1857.

296. East India (Cotton)—Return, Part 2, Madras.
331. Election Expenses—Abstract of Return.

Delivered on 13th and 15th March, 1858.

110. Exports and Imports—Accounts.
105. Bermuda—Return.
114. Committee of Selection—Third Report.
116. Army (Embodied Militia)—Supplementary Estimate.
124. General Committee of Elections—Mr. Speaker's Warrant.
113. Harbour, &c., Bills (Blyth Harbour and Dock; 1. Llanelly Harbour; 2. London Dock Company; 3. Trent Navigation; 4. Whitehaven Harbour; 5. Burghead Harbour; 6. Tees Conservancy; 7. Fishguard Harbour Improvement; 8. Leitrim Railway and Lough Allen Pier; 9. Hesketh Marsh; 10. Yar Bridge; 11. Tyne Improvement; 12. Plymouth Great Western Docks; 13. Wexford Harbour Embankment)—Board of Trade Reports.
117. Railway and Canal Bills (1. Alyth Railway; 2. Caledonian Railway (Dalmernock Branch); 3. Carron Railway; 4. Dundalk and Enniskillen Railway; 5. Ely Valley and Eden Valley Railway; 6. Liskeard and Looe Union Canal Company; 7. Midland Great Western Railway of Ireland; 8. North Yorkshire and Cleveland Railway; 9. Salisbury and Yeovil Railway; 10. Selkirk and Galashiels Railway; 11. South Devon and Tavistock Railway; 12. Lymington, Biggar, and Broughton Railway; 13. Vale of Towy Railway; 14, Worcester and Hereford Railway)—Board of Trade Reports.
East Indies (Mutinies)—Further Papers (No. 6).
Births, Baptisms, &c. (Non-parochial Registers or Records)—Report of Commissioners.

Delivered on 16th March, 1858.

86. East India (North-Western Provinces, &c.—Return (a corrected Copy).
26. Bill—Agricultural Statistics.
France—Correspondence respecting Foreign Refugees in England.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 12, 1858.]

Dated 18th Feb., 1858.

308. W. H. Crispin, Marshgate-lane, Stratford—Imp. in the construction of bearings, beds, and sockets for axles, shafts, pivots, and other rotating parts of machinery.
310. G. Claridge, Pontypool Iron Works, and R. S. Roper, F.G.S., F.C.S., Ebbw Vale Iron Works, Monmouth—An improved mode of manufacturing coke.
312. J. Chadwick, Glasgow—Imp. in machinery or apparatus for engraving or producing printing surfaces.
314. F. Jones, Manchester—Certain imp. in machinery or apparatus for cutting 'piassava,' or other fibrous substances employed in the manufacture of brushes, which said imp. are also applicable to other purposes of cutting.

Dated 19th Feb., 1858.

316. W. Riley, Liverpool—An improved method of raising and lifting water from the bilge or holds of ships and other vessels, and in a peculiar construction and arrangement for effecting the same.
318. J. Champion, Manchester—Imp. in spinning cotton, silk, flax, wool, and other fibrous materials.
320. E. Maw, Doncaster Iron Works, Yorkshire—Imp. in the manufacture of iron wheels.
322. I. Brown, Carlisle, and J. Brown, Notting Hill—Imp. in machinery or apparatus for reducing bones.
324. W. Skallitzky, Vienna—Imp. in the manufacture of socks and stockings.

Dated 22nd Feb, 1858.

326. W. E. Nethersole, Swansea—Imp. in the construction of parts of railway carriages.
330. H. Edwards, Bishopsgate street—Imp. in stoppers for feeding bottles and other vessels.
332. T. Green, Leeds—Imp. in mowing machinery.
334. W. Greene, 21, Merlin's-place, Clerkenwell, and M. C. Greene, 19, Hatton garden—Imp. in joining soft metal pipes.
336. A. Myers, 12, Hutchison-street, Gravel-lane, Houndsditch—Imp. in the manufacture of caps or coverings for the head.
340. W. Betts, Wharf-road, City-road—A new manufacture of glazed or enamelled paper.

Dated 22nd Feb., 1858.

342. John Davis, 11, Burlington-cottages, Queen's-road, Dalston—Imp. in cornets and other wind musical instruments.
344. W. Hall, Erith—Imp. apparatus for working railway breaks.
346. R. A. Brooman, 166, Fleet street—Imp. in machinery for effecting the amalgamation of precious metals. (A com.)

Dated 23rd Feb., 1858.

348. F. Puls, Haverstock-hill—The manufacture of certain hydrocarbons.
350. W. Johnston, Glasgow—Imp. in apparatus for regulating or controlling the flow or passage of fluids.

352. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for separating substances of different specific gravities. (A com.)
354. E. Toynbee, London—Imp. in the manufacture of manure.
356. J. Boydell, 65, Gloucester-crescent, Camden-town—Imp. in locomotive carriages.

Dated 24th Feb., 1858.

358. A. C. Hobbs, 76, Cheapside, London—A domestic bell telegraph.
360. E. Borlase, St. Just, near Penzance, Cornwall—Improved apparatus for separating metals and metallic ores from other mineral substances.
362. J. Henderson, Glasgow—Imp. in shells or explosive projectiles.
364. C. Kaye, Lockwood—Imp. in couplings for connecting and disconnecting wagons and other carriages on railways.
366. A. V. Newton, 66, Chancery-lane—Certain improved means of relieving the slide valves of steam engines of unnecessary friction. (A com.)
368. A. V. Newton, 66, Chancery-lane—A mode of varying the length and reversing the direction of the throw of an eccentric, applicable to the reversing gear of locomotives and expansion gear of other steam engines, and to other purposes. (A com.)
372. A. Applegath, Dartford, Kent—Imp. in printing machinery.

Dated 25th Feb., 1858.

373. W. Tatham, Rochdale—Imp. in machinery, or apparatus for lubricating the pistons, piston rods, cylinders, and other parts of steam or other engines, and which is applicable to other purposes where lubricating matter is required.
374. J. Arnold, Newton Moor, near Hyde—Imp. in metallic pistons.
375. J. B. Barnes, Summer-lane, and J. Loach, Caroline-street, Birmingham—Certain improvements in apparatus for descending and ascending the shafts of mines or other deep pits, the descent and ascent of which imperils the lives of the miners or others employed therein.
376. J. Templeman, Dunfermline—Imp. in the manufacture or production of artificial fuel.
377. W. Slater, and S. Smith, Bolton-le-Moors—Imp. in machinery to be used in turning and cutting metals.
379. J. T. Pitman, 67, Gracechurch street—Imp. in hand lever self-inking printing presses, for printing cards, envelopes, bill-heads, and other articles. (A com.)
380. A. V. Newton, 66, Chancery-lane—Improved machinery for grinding and polishing glass, stone, metal, and other substances. (A com.)
381. L. P. Lambert-Alexandre, Paris—Imp. in apparatus and signals for preventing accidents on railways.

Dated 26th Feb., 1858.

382. J. Morison, sen., and J. Morison, jun., Paisley, Renfrew, N.B.—Imp. in Jacquard apparatus used in weaving.
383. W. C. Smith, 31, Lincoln's inn fields—Imp. in the manufacture of envelopes for letters and other purposes. (A com.)
384. W. Chadwick, Bury—Imp. in ventilators.
385. H. Mackworth, Clifton—Imp. in the separation, raising, and lowering of coal and other minerals, and in cooking, and in apparatus connected therewith.

Dated 27th Feb., 1858.

387. S. Hoga, Nassau-street—Imp. in applying power in locomotion, by which a given force may, in its effect of overcoming resistance, be increased and multiplied.
388. J. Knott, 63, Oakley-street, Lambeth—An improved feeding-bottle.
389. J. T. Raymond and A. Lambert, Caledonian-road—Ornamenting textile fabrics.
391. L. Galli, Milan, Italy—A process of superseding wood engraving, which he calls Gallitypy.
392. W. Cave, Rathbone-place—Imp. in apparatus for propelling vessels, carriages, and machinery.
393. M. Henry, 77, Fleet-street—Imp. in electro-magnetic motors. (A com.)
394. W. A. Gilbee, 4, South-street, Finsbury—An improved union joint for gas, water, and steam pipes, also applicable to the branch pipes of fire-engines. (A com.)
395. W. A. Gilbee, 4, South street, Finsbury—Imp. in the branch pipes of fire-engines or pumps. (A com.)
396. W. Clark, 53, Chancery-lane—Imp. in preparing paper for, and in obtaining, photographic proofs or impressions. (A com.)

Dated 1st March, 1858.

397. J. G. Newey and W. M. Newey, Birmingham—Imp. in fastenings, especially for or applicable to wearing apparel, and purposes where a spring connexion or adjustment is desirable, in arranging for sale and packing fastenings and ornaments, and in ornaments for personal wear.
399. A. V. Schuttenbach, St. Petersburgh—An improvement in treating fatty and oily matters.
400. J. Hadfield, Chelmsford—Imp. in the manufacture of manure and other products, when treating sewage matters, and in the manufacture of colours.
401. J. Kingsford, Upper Marsh, Lambeth—Imp. in lamps.
402. D. Greenley, Upper Cumming-street, Pentonville, and T. B. Daft, Bedford-street North, Liverpool—Imp. in machinery for boring for water, or for other purposes.
403. H. M. Platt, New York—Imp. in ploughing and tilling land.
404. W. E. Newton, 66, Chancery-lane—Improved machinery for removing burrs and other extraneous substances from wool or skins. (A com.)
405. W. E. Newton, 66, Chancery-lane—Imp. in the treatment or preparation of maize or Indian corn, previous to grinding the same into flour. (A com.)
406. J. Billing, Abingdon-street—An improved throat and door for chimneys and flues.

Dated 2nd March, 1858.

407. J. Skelly, Kilcurry, Ireland—Imp. in carriage springs.
408. J. Bircumshaw, Lenton, Nottingham—Imp. in machinery for dressing lace made of silk, cotton, or other material.
409. R. A. Brooman, 166, Fleet street—An apparatus for separating substances of different specific gravities, and for washing sands and earth. (A com.)
410. A. Ripley, 10, Alfred-place, Newington-causeway, Southwark—Imp. in machinery for rolling and polishing leather, and tanned or untanned hides.
411. J. H. Johnson, 47, Lincoln's-inn fields—Imp. in surcharging or regenerating steam, and in the application of the same to steam engines. (A com.)
412. W. Hooper, Mitcham, Surrey—Imp. in the manufactures of buffer and other springs when vulcanized india rubber is used.
413. A. V. Newton, 66, Chancery-lane—An imp. in the process of manufacturing soda and potash. (A com.)
414. W. S. Driggs, New York—Imp. in pianofortes. (A com.)

Dated 3rd March, 1858.

415. E. H. C. Monckton, Parthenon Club, Regent-street—Imp. in distilling and rectifying, and in the apparatus to be employed therein.
417. P. J. Gautrot, Paris—Instantaneous tents, invented purposely for the use of public vehicles called omnibuses, but which can also be applied to any others, open vehicles, carts, or waggons, and travelling hawkers, at a very low cost; new system of shelter against the inclemency of the weather.
419. B. Parker, Hammersmith—The manufacture of materials for coating, cementing, bedding, and otherwise protecting bodies, and which are also applicable to the construction or formation of various articles.
421. W. Scoble, Bow Common-lane, Mile end—Arranging the retorts, furnaces, flues, communications and connections, for the more economical manufacture of gas, and by which arrangement the generative heat may be obtained from either coal, coke, tar, or other similar combustible substances.
423. W. H. Graveley, Upper East Smithfield—An apparatus for purifying sea and other mineral waters, and rendering them fit to drink.
425. G. A. Biddell, Ipswich—Imp. in machines for cutting vegetable and other substances.

Inventions with Complete Specification Filed.

422. G. J. Parson, Adelphi-terrace, Strand, and T. Pilgrim, Bow—Imp. in the mode of raising the temperature of steam generated in steam boilers, and using the same for working steam engines.—3rd March, 1858.
436. C. Eyland, Walsall—An improvement or improvements in certain descriptions of buckles.—4th March, 1858.

WEEKLY LIST OF PATENTS SEALED.

March 12th.

2372. N. Fisher.
2374. C. Watson.
2378. J. Leeming.
2379. W. Gossage.
2381. T. Marsh.
2387. R. Shiers.
2388. J. Ashby.
2390. T. Grahame.
2397. R. Wicks.
2399. A. Seward and C. Seward.
2400. C. W. Lancaster.
2402. J. H. Winder.
2403. W. Middleton, junr., and T. T. Chellingworth.
2414. W. Smith.
2417. J. M. Munro, junr.
2420. C. Delevante.
2446. G. Schaub.
2667. V. Péan.
2841. J. T. Way.
2994. J. Fowler, junr., and W. Worby.
3131. F. Taylor.
3175. J. Cottrill.
3177. I. Holden.
3182. V. Mourot.
32. S. Lees.
62. J. Broadley.
70. M. A. F. Mennons.

March 16th.

2411. I. L. Pulvermacher.
2421. S. Whitehead.
2422. S. Faulkner.
2425. T. Wilson.
2426. D. Lichtenstadt.
2437. W. H. James.
2441. H. Ormson.
2453. M. Theiler.
2458. G. Rennie.
2472. T. Saunders.
2509. J. H. Johnson.
2512. J. Paisley and G. Bertram.
2530. G. W. Shibles.
2535. R. Green.
2541. W. E. Newton.
2552. J. Combe.
2820. W. Macnab.
3172. J. Boydell.
3181. A. Parkes.
5. A. Parkes and H. Parkes.

Patents on which the Stamp Duty of £50 has been Paid.

March 8th.

534. S. C. Lister.
538. S. C. Lister.

March 9th.

555. J. M. Napier.
591. W. Hill.
662. G. A. Barrett, W. Exall, and C. J. Andrewes.

March 10th.

570. W. Galloway and J. Galloway.
768. R. W. Walthman.

March 11th.

571. J. Marland.
749. F. Joyce.

March 12th.

567. B. Goodfellow.
574. E. J. Mitchell.

March 13th.

568. R. Neale.
572. E. V. Gardner.
584. R. M. Butt.
1207. T. Waterhouse.

Journal of the Society of Arts.

FRIDAY, MARCH 26, 1858.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday, the 24th April, at the Society's House, for which a card will be issued to each member; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit a member and two friends, ladies or gentlemen.

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date :—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	£1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P.	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

GALLERIES OF ART AND SCIENCE.

The Council have appointed the following gentlemen a Committee to consider and report on the practicability of establishing Galleries of Art and Science in different parts of the metropolis, which shall be open in the evening.

Henry Cole, C.B.
C. Wentworth Dilke (Chairman of the Council.)
William Hawes.
J. C. Macdonald.
George Moffatt, M.P.

REPORT OF THE ARTISTIC COPYRIGHT COMMITTEE TO THE COUNCIL.

Your Committe, appointed by your minute of the 2nd day of December, 1857, for inquiring into the subject of Copyright in Works of the Fine Arts, have examined the matters referred to them, and agreed to the following

Report.

At their first meeting, your Committee appointed Sir Charles Eastlake, President of the Royal Academy, their Chairman; John Lewis, Esq., (then President of the Society of Painters in Water Colours) Deputy Chairman; and D. Roberton Blaine, Esq., Barrister-at-law, Reporter.

Your Committee have held ten meetings, which on all occasions have been numerously attended.

For the purpose of clearly defining the objects of your Committee, they passed the following resolutions on the 31st day of December, which were inserted in the Journal of your Society, and otherwise extensively circulated :—

"Resolved—That the inquiries of this Committee be directed

1. To ascertain the existing laws of British Artistic Copyright, and the chief defects of those laws.
2. How those defects affect the interests of producers of works of Art.
3. How they affect the interests of purchasers of works of Modern Art.
4. How they affect the interests of the public and the promotion of the Fine Arts.
5. How they affect the subjects of those foreign States with whom Her Majesty has entered into International Conventions; and what the laws of those States are as affecting Artistic Copyright.
6. To obtain instances of fraudulent or wrongful acts relating to works of Modern Art.
7. And lastly, to suggest such remedies as appear best calculated to amend the defects of our Artistic Copyright laws."

The Committee also passed a resolution, requesting Mr. Roberton Blaine to report to them upon the existing English common and statute-law relating to Artistic Copyright. In consequence of the interest mutually acquired by British artists and aliens under the various International Copyright Conventions, entered into by Her Majesty with Prussia, France, and other foreign states—and the Orders in Council founded on those Conventions—the Committee considered it advisable that the Report to be made to them should contain some notice of the Artistic Copyright Laws of these States. The document prepared by Mr. Blaine, in pursuance of the resolution above referred to, having been presented to your Committee, it was then, with your sanction, also printed and extensively circulated, in order that the public might be informed of the defective state of our laws of Artistic Copyright. Your Committee have likewise annexed it to this their Report, as it includes and answers the first five of the above resolutions of your Committee. It is marked (A) in the Appendix.

With respect to the sixth Resolution, passed by your Committee on the 31st December, namely, "To obtain instances of fraudulent or wrongful acts relating to works of modern Art," the Chairman of your Committee issued a circular letter, accompanied by a set of questions, Copies of which are appended to this Report, and marked (B) and (C) in the Appendix.

A very large number of answers were received in reply from many of the most distinguished artists, and other persons connected with the Fine Arts.

These answers afford most ample and conclusive evidence of the defective state of the laws of British

Artistic Copyright, and of the wrongful and fraudulent acts which are extensively and constantly committed with impunity, to the serious injury of artists and the purchasers of works of Art, as well as to the demoralization of the parties to such acts; but the communications made having been received confidentially, your Committee are prevented from publishing them.

Your Committee thereupon proceeded to pass the following Resolutions:—

I. That the existing laws of British Artistic Copyright are exceedingly defective and unjust. The chief defects are:—

1. That they afford the producers of works of Art no sufficient protection against the piracy of their productions.
2. That the purchasers of such productions are equally unprotected, and their property therein liable to invasion and injury.
3. That in consequence of this defective state of our laws of Artistic Copyright, direct encouragement is given to the extensive manufacture, which is carried on, of spurious copies of works of Art, which copies are extensively sold as originals, to the serious injury of the fame of the authors of such original works, the pecuniary loss of the purchasers of the spurious copies, and the demoralisation of the young or needy artists employed to manufacture such copies.
4. That our Artistic Copyright laws are unjust in their operation upon the Subjects of those foreign States who have entered into International Copyright Conventions with Her Majesty, inasmuch as such treaties are based upon the principle of *reciprocity*, and that while under those treaties the works of British artists first published in the British dominions are protected from piracy within the territory of the foreign State named in any such treaty, no similar protection is afforded in the British territories in respect of the works by artists of such foreign States.

II. That the interest of art and artists, as well as of the public, require the laws of British Artistic Copyright should be amended.

With reference to the last resolution of the 31st December, namely, "to suggest such remedies as appear best calculated to amend the defects of our Artistic Copyright Laws," your Committee, after numerous meetings and lengthened discussions, passed the following resolutions:—

That any Bill which may be prepared for the amendment of the laws of British Artistic Copyright should, in the opinion of this Committee, include the following clauses:—

1. The repeal of all the existing Acts relating to Artistic Copyright.
2. That the amending Act should extend to all parts of the British dominions.
3. That it should protect all works of Art by British authors, although executed or first published in any Foreign State.
4. That it should likewise protect all works of Art by *alien* authors (whether friends or enemies), although executed or first published in any Foreign State.

On arriving at this stage of their proceedings, your Committee decided upon postposting the further consideration of clauses for any Bill which may be prepared, and passed the following resolutions:—

1. The chief object it is desired to effect by the Amending Act, is to secure a Copyright for the Author's life, and 30 years after, for such of the designs of an artist as he may himself have conceived, and as have been produced by his own hands, or by those of his assistants, and as he may himself have signed or marked, so as to claim Copyright for.

   [These would be works of which the artist's own brain may be considered as the inventor and primary source, and would include all, however first embodied; and whether they profess to be portraits of men or things, or the products of imagination: and will apply especially to the works of
   Painters and Designers,
   Sculptors and Die Engravers,
   Architects.]

2. The next object desired is, to secure protection for a like period of works of Art of a more imitative character, and not necessarily embodying original design, and to prevent these being used by strangers as a means or basis for reproducing others like them, to be sold in competition with themselves.

   [This will include the case of the piratical user by one engraver or photographer of the work of his rival, in order to make repetitions from, while it leaves the original design or other source open to both parties, and will apply principally to
   Engravers,
   Photographers,
   Plaster, &c., cast makers.
   E.g.—Mr. Doo may choose to engrave an old National Gallery picture. Any other engraver may go to the picture and engrave another, but he has no right to use Mr. Doo's engraving to produce it from. So with a photographer who may travel to the Holy Land, and bring back photographs. Others ought not to use his, though they may also go to the Holy Land and get the same subject there.]

3. The third object desired is, to secure, for a like period, Engravers against plates which have been engraved by them, and bear their name, being touched over and altered by others, and then re-issued with the engraver's name still on them.
4. It is desired to extend (as was done for authors in 1842) the Copyright above contemplated, to all the past works of living artists which they have still in their possession; and also to those which they have parted with, provided they obtain the consent of the proprietor, and affix their name or monogram.

Qualification on the Copyright above proposed.

1. As to architectural plans, models, &c.; only the use of the originals to be secured; but not to prevent new drawings, &c., being taken from executed buildings or works.
2. As to sculpture; only to prevent the publishing of copies, casts, engravings, &c., purporting to represent or reproduce the original design as the sole or chief end of the publication.

   [*E.g.*—No stranger ought to engrave one of the statues at the entrance of the House of Lords as a work *per se*. While a picture of the whole scene, including the set of statues as incidents, would be within the rule known as to Copyright books, permitting legitimate extracts not being competitions with the original work or design.]

As to Protecting the Public against Frauds.

The object is to to guard the public against—

1. The making, or causing to be made, copies of works of Art, for the fraudulent purpose of selling or exchanging such copies as originals.
2. The fraudulent sale or exchange of copies as originals.

3. The fraudulent use of artists' or engravers' names, as to works which are not theirs.
4. The passing off fraudulently re-touched engravings as first proofs, &c., or as the works of the original engraver, though re-touched by other hands.

The mode of effecting this is proposed to be by making—

1. The copying, or knowingly uttering of the copy of artists' names or monograms a felony.
2. The other offences a misdemeanour.

As to Legal Procedure to Enforce Copyrights.

In addition to such remedies as law would give—

1. Penalties, not less than £5, and not exceeding double the value of the design or work pirated, to be recoverable for each offence, in manner provided in Ornamental Designs Copyright Act, 1842.
2. Power to Courts and Justices to order the delivery up or the cancelling of pirated articles.

Very considerable discussion took place upon the point whether the *registration* of works of Art ought or ought not to be made a condition precedent to the acquisition of any Copyright therein, and your Committee ultimately resolved that no such registration ought to be required, and thereupon passed the following resolutions:—

1. That having regard to the number of works of Art which are daily produced; to their nature; and to the circumstances under which they are produced, it is the opinion of this Committee that a complete Copyright Registration, by all British and Foreign artists, so arranged as to show, through Drawings, Models, or the like, all the matter for which Copyright is proposed to be conferred, would be wholly impossible. That its attainment is not desired by artists or publishers, and that no advantage would arise from it to the public.
2. That to make Registration a condition precedent to the acquisition of Artistic Copyright, would render it necessary that every work tendered to exhibition, although refused, and every sketch in the folio of the artist, should previously have been sent to London and registered, and so would be to place artists under a condition not imposed upon authors, and by the difficulty of the task imposed and the expense involved, and by the unnecessary centralization of the office, would debar the bulk of the body from the benefit of the proposed law. It would also render it impossible to grant a Copyright to the past works of living artists.
3. That to make Registration a condition precedent, would further be to encourage the commission of piracies on artists and frauds on the public, because the parties dealing in such piracies and frauds would be always on the alert to avail themselves of every slip in the registry, just as has always been the case with respect to patents.
4. That, in considering this subject, it should be borne in view that artistic piracies are, in their nature, more injurious to the public than those committed on authors or ornamental designers; because, in the latter cases, the purchaser is as well-served and contented with the pirated work as he would have been with an original; whereas, upon infringements of Artistic Copyright, the purchaser of the pirated copy is often much more injured than the artist. The case most analogous to the one under the consideration of the Committee, is that of pirated trade marks, as to which no registration is required by law, and on which, with reference to a foreign trade mark pirated here, his honour, Vice Chancellor Wood, has lately used the following most apposite words,—"I cannot conceive anything short of indictable offences more discreditable than such proceedings." (3 Kay and J. 433.)
5. In considering the subject of imposing registration as a condition precedent to title, it should further be borne in mind that such a law makes title always turn on points wholly immaterial to the justice of the case; and that the experience of the mischiefs arising from such a registry, 1st as to shareholders or joint stock Companies, and 2nd and 3rd as to ships and patent rights, has lately led the Legislature almost entirely to abolish the 1st, and greatly to modify the 2nd and 3rd.
6. That the position in life and want of business training of artists, the pecuniary difficulties which so many of them have to contend with, the remote places in which their studies are constantly made and their works often produced, the frequent changes made in them, often long after their first publication and sale, should be had in view before a condition is imposed so onerous to them in its performance and so sure to be neglected, and would make it necessary that they should, as authors now do, only connect themselves with the purchaser and public through publishers or dealers, a state of things as regards the influence of art to be deprecated.
7. If, notwithstanding these considerations, doubts should still be entertained by the Legislature as to the propriety of imposing some registration, then this Committee submits that such imposition should be postponed until the proposed new law has been at work long enough for experience to develop those points (if any such there should have to be) to which such a registration should be directed.

Charles L. Eastlake, P.R.A. (Chairman.)
John Lewis (Deputy Chairman.)
*D. Roberton Blaine (Reporter), *subject to the protest below.*
Joseph Arden.
Francis Barlow.
*Jacob Bell, F.L.S.
*John Bell.
William John Broderip, F.R.S.
*F. S. Cary.
*A. E. Chalon, R.A.
*A. Claudet, F.R.S.
C. R. Cockerell, R.A.
J. D. Coleridge (*except as to the resolutions relating to registration.*)
*H. Cole, C.B.
David Cox, jun.
Thomas Creswick, R.A.
Henry Darvill.
*C. Wentworth Dilke, (Chairman of Council.)
*John Dillon.
George Thomas Doo, R.A.
*William Dyce, R.A.
Andrew Edgar (*subject to the protest below.*)
Francis Ellis (*subject to the protest below.*)
James Fahey.
*Roger Fenton.
Edwin Field.
*Robert Fletcher.
*William M. Fladgate.
John Henry Foley, R.A.
William Powell Frith, R.A.
*George Godwin, F.R.S.
Louis Haghe.
William Hallowes.
Solomon A. Hart, R.A.
William Hawes.
J. R. Herbert, R.A
F. Y. Hurlstone, (President of the Society of British Artists.)
Joseph J. Jenkins.
*Owen Jones.
F. Joubert.
J. P. Knight, R.A.
R. S. Lauder (President of the National Institute of Fine Arts.)
*John Leighton, F.S.A.
John Linnell.
Daniel Maclise, R.A.
*William Mulready, R.A.
John Murray.
*Matthew Noble.
F. R. Pickersgill, R.A.
*Henry Pollock.
John Pye.
R. Redgrave, R.A.
*Sir W. C. Ross, R.A.
George Scharf, jun.

Bell Smith.	E. M. Ward, R.A.
Frank Stone, A.R.A.	H. Warren (President of the New Society of Painters in Water Colours.)
Frederick Tayler (President of the Society of Painters in Water Colours.)	*R. Westmacott, R.A.
Tom Taylor.	
*William Tooke, F.R.S.	

* Members of the Society of Arts.

A protest was made by Mr. Roberton Blaine against the decision of the Committee upon the question of registration of works of Art as above stated, which protest was ordered to be entered upon the minutes of the Committee, and is as follows:—

The undersigned protests against a system of non-registration of works of Art for the following amongst other reasons:—

1. That, as between the author of a work of Art and the public, it is the only means by which a reliable record can be obtained of the time when the Copyright in such work will commence, and consequently when it expires.
2. That in cases where the author of a work of Art sells it, but reserves his Copyright therein, registration is the only certain and equitable mode by which the evidence of any such reservation can be preserved, and made to run with the possession of the work to which it relates, so as to be binding on all persons through whose hands the work may pass from the first purchaser.
3. That registration would always afford the authors of works of Art a certain and indisputable record that they are entitled to the Copyright of such of their works as are registered, unless their contracts for sale thereof appear upon the register.
4. That in cases of *piracy* of the Copyright, registration would form a most valuable record, at any distance of time, of the identity of the work pirated, the time and place of its first publication, and the name of the author; evidence of all which essential facts it would, after a considerable lapse of time, in most cases be found impossible to obtain except by means of a Register.
5. That the publicity of registration will materially aid in preventing a continuance of these acts of piracy and fraud to which artists and purchasers of works of Art are now exposed.
6. That the principle of compulsory registration has already been repeatedly established by the Legislature, viz., as to Copyright in Useful and Ornamental designs; and
7. Also as to works of Literature and of the Fine Arts under the International Copyright Act, and the various Conventions entered into by Her Majesty with Foreign States.
8. Because, by the existing Engraving and Sculpture Copyright Acts, no Copyright can be acquired in a work of Art unless the date of its first publication, and the name of the proprietor of the Copyright appear thereon, so that the public may know that a Copyright therein is claimed by the author, and when it will expire.
9. Because a system of registration would afford a cheap and easy mode of assigning Artistic Copyrights, by entry in the Register, as may now be done with respect to literary and musical Copyrights, as well as those in maps, charts, and plans.
10. Because, as the law now stands with respect to literary and musical productions, &c., no proceedings at law or in equity can be maintained for piracy, unless the work in respect of which Copyright is claimed has been previously registered.
11. And lastly, That with all these facts in favour of registration, it is unreasonable to suppose Parliament will grant the additional protection required as to Copyright in works of Art without making the registration of such works a condition precedent to the acquisition of any Copyright therein.

D. ROBERTON BLAINE.

APPENDIX.

(A.)

Mr. Blaine's Report to the Committee on Artistic Copyright.

In pursuance of the Resolution passed at the first Meeting of the Committee, I have prepared the following Report as to the existing English Common and Statute-law relating to Artistic Copyright.

I. *As to the Common-law Right.*

By the Common-law of England, no Copyright or protection exists in favour of Works of Art, except to this limited extent, namely, that while they remain *unpublished*, without the consent of the artist, or owner, no one can lawfully publish them without such consent. This principle has become established by analogy with a long series of decisions, chiefly as to literary productions. Thus, where Her Majesty the Queen and the Prince Consort had made several etchings, and impressions thereof were taken for their private use, and not for publication; impressions of these etchings having been obtained by surreptitious means, and the parties in possession thereof being about to publish the same, the Court of Chancery, upon a Bill filed by the Prince, restrained the defendants from publishing the etchings, or any catalogue thereof. The Lord Chancellor (Lord Cottenham) upon that occasion, said:—"The *property* in an author or composer of any work, whether of Literature, *Art*, or Science, such work being *unpublished*, and kept for his private use or pleasure, cannot be disputed after the many decisions in which that proposition has been affirmed or assumed." His Lordship at the same time held that the exclusive right of the author in *unpublished* works depends entirely on the Common-law right of property therein.*

In a more recent case, decided in the House of Lords, upon a question of Musical Copyright, Lord St. Leonards also said:—"The Common-law does give a man who has composed a work a right to that composition, just as he has a right to any other part of his personal property; but the question of the right of excluding all the world from copying, and of himself claiming the exclusive right of for ever copying his own composition, *after he has published it* to the world, is a totally different thing." His Lordship also held that no Common-law right exists after publication †

It was formerly held by Lord Mansfield, and other eminent Judges, that the authors of literary works had, by the Common-law, a copyright in their works *after* publication, and consequently that such Copyright was perpetual; but that doctrine was long since overruled by the House of Lords in the celebrated case of "*Donaldson* v. *Becket*."‡

The result is that the Common-law affords artists no protection whatever against the piracy of their works *after* the publication thereof by public exhibition, and that they are consequently dependent, for the very slender and imperfect protection they do enjoy for any Copyright in such works, upon

* *Prince Albert* v. *Strange:* 1 Hall and T. pp. 21. 22.
† *Jefferys* v. *Boosey:* 4 Clark's H. L. C. pp. 977, 978.
‡ See 4 Burr. 2408; 2 Bro. P. C. 129.

II. *The Statute-laws of Artistic Copyright.*

These laws may be classed in the following divisions:—

1. The Engraving Copyright Acts.
2. The Sculpture Copyright Acts.
3. The British International Copyright Acts.
4. The Conventions and Orders in Council founded thereon.

I shall not notice the Useful and Ornamental Designs Acts, excepting so far as the latter relate to works of sculpture; because the designers of useful and ornamental articles have obtained a reasonable amount of protection in favour of their labours, and also because the objects of this Committee appear to be an investigation of the state of the laws of England relating to those productions which more strictly come within the definition of "the Fine Arts," such as paintings, engravings, works of sculpture, &c.

The British Engraving Copyright Acts are:—

1. The 8th George II., c. 13, 1735.
2. The 7th George III., c. 38, 1767.
3. The 17th George III., c. 57, 1777.
4. The 6th and 7th William IV., c. 59, 1836.
5. The 15th Victoria, c. 12, sec. 14, 1852.

It will be observed that the first of these Acts is upwards of 120 years old. It does not in any way protect any picture or drawing, as *such*, from piracy *after* its publication; its object was to protect *engravings* from piracy, including therein, as I believe, the designs for such engravings, and also maps, charts, and plans. For that purpose it gave a term of fourteen years' Copyright in engravings which any person should invent and design, engrave, &c., or, from his own works, should cause to be designed and engraved, &c., such term of fourteen years to commence from the day of first publishing any such engraving; and that the public might know when that day was, and consequently when the Copyright would expire, the following *conditions* are imposed upon the proprietors of the Copyright in the engraving:—

1. That the true date of first publication shall be engraved upon the plate.
2. Also the name of the proprietor.
3. And that these particulars shall be printed on every impression taken from the plate.

This antiquated Act was framed upon the statute of Ann relating to Literary Copyright Works, and with slight amendments has remained unaltered down to the present time It is generally known as *Hogarth's* Act, from the circumstance of that great artist having obtained it by his own endeavours, and almost at his sole expense; facts which he has recorded upon a plate engraved by him in commemoration of that important and interesting event in his life.

Hogarth's Act only protected engravings made by an artist, or caused to be made by him from his *own* designs. This defect was remedied in 1767, by the Act of 7 Geo. 3, cap. 38, and the term of Copyright was extended from fourteen to twenty-eight years, that being the increased term which had then been granted in favour of literary productions. This term of twenty-eight years Copyright in engravings still remains unchanged; and, as before observed, it commences from the day when the engraving is first published.

In 1777 the Act of 17 Geo. 3, cap. 57, was passed, which after reciting the two previous Acts, that they had not effectually answered the purposes for which they were intended; that it was necessary for the encouragement of *Artists*, and for the securing to them the *property* of and in their works, and for the advancement and improvement of the arts of engraving, &c., that further provisions should be made for these purposes, it was enacted that, in addition to any damage the proprietor of the Copyright might recover for and infringement thereof, he should be entitled to *double* costs of suit. This and other similar enactments as to double costs, were, however, repealed in 1842 by the 5 and 6 Vic. cap. 99, sec. 2, which, in lieu of such double costs, gives a full and reasonable indemnity as to all the costs, &c., incurred in and about the action which may be successfully brought by the proprietor in consequence of any infringement of his Copyright.

It was only so recently as 1836 that the English Engraving Copyright Acts were extended to Ireland, by the 6 and 7 William IV., cap. 59. Up to the time of the passing of that Act, engravings first published in England might be and were pirated in Ireland with perfect impunity; and those first published in Ireland were, in like manner, subject to piracy in England.

In consequence of doubts having been entertained whether "lithographs and certain other impressions" were within the protection of our Engraving Acts in 1852, it was declared by the 15 Victoria, cap. 22, sec. 14, that they were intended to include "prints taken by lithography, or any other mechanical process."

Having thus briefly stated the substance of all the existing British Engraving Copyright Acts, I will now point out what appear to be some of the chief defects in these statutes. I shall adopt the same plan with respect to the British Sculpture Copyright Acts; and will conclude with some notice of the British International Copyright Acts, and the Conventions and Orders in Council founded thereon, so far as they relate to Works of the Fine Arts.

The chief defects of the British Engraving Copyright Acts are,

I. That they give artists no Copyright in their pictures, *as such*, but only for the purposes of engraving.

II. They afford no protection to the purchasers of original pictures against the piracy thereof.

III. They afford the public no protection against the purchase of spurious pictures, and thus operate as an encouragement to the grossest acts of fraud.

IV. That architects are quite unprotected in respect of their published designs, unless engraved before publication.

V. That the new art of photography is also entirely unprotected as respects Copyright.

VI. That the existing Acts only extend to Great Britain and Ireland.

VII. That the term of twenty-eight years Copyright is insufficient.

VIII. The expense attendant upon the assignment of Copyright by deed.

IX. And the expense attendant upon proceedings for the protection of Copyrights.

I. That the existing Acts give artists no Copyright in pictures, as such, but only for the purpose of engraving, will be fully understood when it is seen that, according to Hogarth's Act, a picture is only treated as a *design* for the purpose of engraving from. Both for fame and profit, Hogarth appears to have relied upon his original art, rather than that of a painter; it was his *engravings* that were pirated, and his Act was, therefore, framed to meet the requirements of his own case, and those of other artists similarly placed. Some of the chief mischiefs to which this state of the law exposes an artist are as follow,

1. After he has sold his picture he has no means of preventing its piracy, either as a picture, or for the purposes of engraving, excepting as between himself and the person to whom he has sold it. Contracts are often made by artists with the purchasers of their pictures, by which contracts the Engraving Copyright is secured to the artist. Such contracts are constantly avoided by the purchaser selling the picture to a third person without notice of the artist's contract as to the Copyright. He is thus defrauded of his property,

and his fame as an artist is exposed to serious injury.

2. Unless a picture be engraved, and the impressions published as Hogarth's Act directs, before such picture be publicly exhibited, no Copyright can, in my opinion, be acquired even in the *design* of the picture for the purposes of engraving; it is for ever lost to the artist.
3. And by depriving an artist of any Copyright in the design of his work, unless it be thus engraved before exhibition, he is denuded of an inducement to devote himself to those higher classes of pictures which require the greatest amount of thought and time in their composition; the best interests of Art are thus damaged.

II. The fact of the Engraving Acts affording no protection against the piracy of pictures is a mischief which affects the purchaser as well as the artist. Much of the *conventional* value of a picture depends upon its being *unique*. If protected against piracy, purchasers of pictures would have a further inducement given them to add to their collections, and they would buy with a confidence which is now impossible.

III. These Acts likewise afford the public no protection against the purchase of *spurious* works, and thus afford direct encouragement to the grossest acts of fraud. This Committee will doubtless be furnished with numerous instances of those frauds which have long been so extensively practised upon artists and the public in respect to pictures. In the mean time, I will only mention the recent decision of *The Queen v. Closs*. In that case a picture had been painted by Mr. Linnell, who signed and sold it for £180. The prisoner was a picture dealer, and was indicted for fraudulently selling a copy of Linnell's picture as and for the genuine picture which he had painted. Mr. Linnell's name was likewise painted on such copy, which the prisoner sold for £130. The indictment contained three counts: the first charged the prisoner with obtaining money under false pretences, but upon this count he was acquitted; the second count charged him with a *cheat* at Common-law, by means of writing Linnell's name upon the copy; and the third count charged the prisoner with a *cheat* by way of forgery of Linnell's name upon the copy. Upon these two last counts the prisoner was convicted; but his counsel objecting that these counts disclosed no indictable offence at Common-law, the judgment was respited in order that the opinion of the Criminal Court of Appeal might be taken upon the objection so raised on the part of the prisoner. The case was afterwards argued before five Judges, who formed such Court of Appeal, and they unanimously held that the conviction of the prisoner was *wrong*; that there was no *forgery*: and that "a forgery must be of some document or writing, and Linnell's name in this case must be looked at merely as in the nature of an arbitrary mark made by the master to identify his own work." As to the second count of the indictment, the court held that the conviction could not be sustained, because it did not sufficiently show that the prisoner sold the copy *by means* of Linnell's signature being forged upon it.*

The consequences of this decision, as respects the interests of artists, of the purchasers of works of Art, and the public morality, are too apparent to need any comment.

IV. Architects are entirely unprotected, in respect of their published designs, unless they engrave or lithogragh, and publish them as Hogarth's Act directs; in which event it would be an act of piracy to copy them for publication without the consent of the proprietor of the Copyright.

V. The new art of photography is likewise entirely unprotected as respects Copyright. Whatever may be the expense which has been incurred, and although the artist's name may be placed upon his works, any one may copy them, at any time *after* their publication, to the serious injury of the fame and profit of the original artist.

VI. The existing Engraving Copyright Acts only extend to Great Britain and Ireland, and do not include the Colonial, or any other portion of the British dominions, not even the Isle of Man, or the Channel Islands; these Acts being expressly confined to such prints as have been "engraved, etched, drawn, or designed in any part of Great Britain* or Ireland."† If so engraved, &c. out of the United Kingdom, it appears that no Copyright can be acquired under the Acts in question. Thus where a Bill was filed in Chancery to restrain the piracy of certain prints forming part of a book, which prints had been designed and engraved abroad, and only *published* with the book in England, the Court held that the plain object of the legislature was to protect those works only which had been *executed* in Great Britain (or Ireland), and not those which were only published there.‡

VII. The term of twenty-eight years' Copyright granted by the Engraving Acts is too short. I have already stated that these Acts were framed upon the Statutes relating to literary Copyright works, in which the term was originally fourteen years, but was afterwards increased to twenty-eight. In 1842 that term was by the Literary Copyright Amendment Act extended to a certain term of forty-two years, with the chance of a longer period, according to the author's life. The designers of maps, charts, and plans are included in that protection.§ As therefore Parliament has conceded the principle, that the *property* in books, music, maps, charts, and plans shall be protected from piracy during a certain period of forty-two years, is it just to exclude the property of artists in their productions from a similar advantage?

VIII. The expense attendant upon the assignment of an artistic Copyright is a serious defect. Under the existing Acts no *valid* transfer of such a right can be made by the owner except by a *deed* signed by him, attested by *two* witnesses, and stamped with the proper *ad valorem* duty on the price of the Copyright, if sold. An assignment by deed was formerly requisite for assigning literary Copyrights, but the Literary Copyright Amendment Act of 1842 remedied that defect as to books, music, maps, charts, and plans, by enabling the proprietor of the Copyright to transfer it by entry in the Register at Stationers' Hall, *or* by deed.

The generally received opinion amongst engravers, printsellers, and auctioneers of artistic property, that the *Copyright* in a plate passes with the sale and *delivery* of such plate, is entirely fallacious, as the purchaser would find to his cost if he brought an action in his own name for the infringement of the Copyright, without having obtained an assignment of it by deed, attested by two witnesses.

IX. The expense attendant upon the requisite proceedings for the protection of a Copyright in cases of piracy is a most serious defect under the existing Acts; it is, however, a defect which is alike applicable to the whole body of our Statute-law affecting Copyrights of all descriptions. Even in the most flagrant instances of piracy, the proprietor of the Copyright has no remedy against the pirate except by an action at law for an injunction and damages, or a suit in Chancery for an injunction and account. The power recently given to the Courts of Common-law to grant injunctions is a great boon to the proprietors of Copyright, where their means, or the value of the Copyright at stake, are such as to

* See Weekly Reporter, 12th Dec. 1857, p. 109.

* See 17 Geo. 3, cap. 57.

† 6 and 7 Will. 4, cap. 59, sec. 1.

‡ Shadwell, V. C. in *Page* v. *Townsend*, 5 Sim. 395.

§ It has been held that *woodcuts*, illustrative of the letterpress of a book, and published therewith, are within the protection of this Act, as forming part of the book. Per Parker, V. C. in *Bogue* v. *Houlston*, 12, L. I. Ch. 470.

warrant their embarking in a law-suit in one of the superior Courts.

All the legislation which has taken place upon the subject of Copyright in England has proceeded upon the just theory that an author or artist has a *property* in his work. Where, therefore, a Copyright work is *literally* copied, or copied with merely colourable alterations, it seems difficult to distinguish the moral guilt of such a theft from that of picking a pocket, and consequently that such an act of piracy ought to be punishable as a *criminal* offence.

The British Sculpture Copyright Acts are:—

1. The 38th George III., C. 71. 1798.
2. The 54th George III., C. 56. 1814.
3. The 14th Victoria, C. 104, ss. 6, 7. 1850.

These Acts form the sole protection against piracy which a sculptor has in respect of any Copyright in his works *after* their publication.

The first of the above Statutes gave a term of fourteen years' Copyright in new works of sculpture. The next recites that the previous Act had been found ineffectual for the purposes thereby intended, and also gave a term of fourteen years' Copyright in new works of sculpture, together with a further term of fourteen years if the sculptor should be living at the end of the first term, and should not have divested himself of his Copyright. Both these Acts impose the following *conditions* upon the proprietor of the Copyright in any work of sculpture, and these conditions must be strictly performed, or he forfeits his Copyright therein.

1. That the proprietor of the Copyright shall cause his name to be put on his work before the same shall be published; and—
2. Also the date of such first publication.

The above Acts were amended in favour of sculptors by the Ornamental Designs Act of 15 Vic. cap. 104, ss. 6, 7, which enables sculptors to bring such of their works as are "within the protection of the Sculpture Copyright Acts," also within the protection of the Designs Act upon *condition* of such works

1. Being registered under the Designs Act.
2. That the word "Registered" shall appear upon every copy or cast of the work published by the sculptor, or his assigns, after its registration; and
3. The date of registration.

The defects of the Acts relating to Copyright in Works of Sculpture.

These defects appear to be almost as important and numerous as those I have mentioned with respect to the Engraving Copyright Acts. The second, third, sixth, eighth, and ninth are applicable as well to the former as to the latter of these Acts, and I will therefore not repeat them. In addition, the following may be noticed:—

I. The *certain* term of fourteen years' Copyright is insufficient.
II. A sculptor can acquire no Copyright in his works for purposes of engraving.
III. It seems doubtful whether a work of sculpture can be protected under the Designs Act without the performance of two sets of conditions.
IV. The works of sculpture are most frequently pirated by a class of persons against whom the existing laws afford a useless remedy.

I. The *certain* term of fourteen years' Copyright is insufficient. It is only extended to twenty-eight years if the sculptor outlives the first fourteen after the publication of his work. The interests of his *family* are lost sight of in this arrangement, and that the present term of Copyright allowed for works of sculpture is insufficient surely must be admitted when it is remembered that twenty-eight years are conceded for engravings, and forty-two years *certain* for books, music, maps, charts, and plans.

Sculptors have likewise a strong claim to an extended term of Copyright, from the peculiar nature of their works. It frequently happens that a sketch is made of a statue which is not commissioned for many years afterwards. Now, to insure his Copyright in such sketch, or first model, it seems that the artist must place his name and date upon it when he first publishes or exhibits it. The first fourteen years Copyright runs from that day, and may therefore expire before the work has been executed upon an enlarged scale, and consequently when so executed it would be entitled to no Copyright.

II. A sculptor can acquire no Copyright in his works for the purposes of *engraving;* a painter may. If well designed and engraved, the Copyright in a sculptor's works might be profitable to him in various ways; on the other hand, if they are badly designed and engraved, his professional reputation may be injured with those who have not had an opportunity of examining his works.

III. It seems doubtful whether a work of sculpture can be protected under the Designs Act, without the performance of the *conditions* I have noticed as being imposed under the Engraving Copyright Acts; and also those under the Designs Act, because the latter only extends to such works of sculpture as are "within the protection of the Sculpture Copyright Acts;" and no work can be brought within such protection without the performance of the conditions imposed by those Acts.

IV. The works of sculptors are most frequently pirated by a class of persons against whom the existing laws afford a useless remedy. These persons are generally indigent Italians, and other aliens, wholly unable to pay any costs or penalties which might be recovered against them. How defective the present Sculpture Copyright Acts are in this respect may be judged of by the fact that only *one* reported case arising under these acts is to be found. The instances of piracy are constant, but sculptors have wisely submitted to the invasion of their rights rather than embark in litigation with men of straw.

Report of the Select Committee on Arts and Manufactures.

In 1836 the House of Commons appointed a Select Committee "to inquire into the best means of extending a knowledge of the Arts, and of the principles of design, among the people (especially the manufacturing population) of the country; also to inquire into the constitution, management, and effects of institutions connected with the Arts." That Committee, by their Report, stated that they began their labours by dividing the subject of their inquiry into three parts; the two first being as to art as relating to manufactures; and the third, as to "the state of the higher branches of Art, and the best mode of advancing them." The Committee also stated that their investigations had been principally directed to the two first subdivisions of the subject, but they drew attention to the defective state of the law as affecting *Artistic Copyright,* especially as to works of sculpture, at the same time stating that "the expensiveness of a remedy through the courts of law or equity is a virtual bar to invention, and almost affords impunity to piracy "in Art;" that a system of *registration* appeared to be indispensable; and concluded their Report thus:—"It will give your Committee the sincerest gratification, if the result of their inquiry (in which they have been liberally assisted by the artists of this country) tend in any degree to raise the character of a profession which is said to stand much higher among foreign nations than in our own; to infuse, even remotely, into an industrious and enterprising people a love of Art, *and to teach them to respect and venerate the name of 'Artist.'*" Parts one and two of the Appendix to this Report contain a considerable amount of interesting and important evidence relating to Artistic Copy-

right. The Useful and Ornamental Designs Acts were subsequently passed; but, with the exception I have already noticed as to works of sculpture, our laws of Artistic Copyright still remain unaltered, except as to international rights, which I shall notice presently.

The passing of the Literary Copyright Amendment Act in 1842 was mainly attributable to the generous and unwearied exertions of the distinguished and noble-hearted author of "Ion," the late Hon. Mr. Justice Talfourd. In a letter I received from him in 1853, after noticing "the necessity of a complete revision of the confused and ineffective statutes" relating to Artistic Copyright, he says, "in the first Bill which I introduced into the House of Commons, I included a series of clauses on this subject; but I subsequently, by the advice of Sir Robert Peel, confined the measure to Literary Copyright, as he thought that the difficulties attendant on the question between artists and the patrons of Art would only be solved by a Select Committee; and as this was a subject on which he was personally sensitive, I found it necessary to adopt his advice, or to encounter his opposition, which must have been fatal. I always, however, cherished the hope of bringing the subject before the Legislature until I ceased to be one of its members; and I shall rejoice if some one possessed of more influence should be induced to move for a Select Committee on the Statutes."

I have noticed this letter because it proves that its generous writer did not neglect the interests of artists, as has been supposed, in his long battle in the House of Commons to obtain an amendment of the laws of Copyright. It also proves that he, as well as one of the greatest British statesmen, the late Sir Robert Peel, knew and admitted the necessity for an amendment of our Artistic Copyright laws.

III. *The British International Copyright Laws.*

These laws consist of:

1. The Act of 7 Victoria, C. 12, 1844.
2. The 15 Victoria, C. 12, 1852.
3. And the various Conventions and Orders in Council made under the above Acts.

Before entering upon any notice of these Acts, &c., it seems desirable to state, that by the law of England, as it existed prior to the passing of any International Copyright Act, no Copyright could be acquired in the British dominions in respect of any literary or other work which had not been either *first* published there, or simultaneously with its first publication in any other State. The consequence of this principle of our laws of Copyright was to deprive *aliens*, as well as British subjects, of any Copyright in their works in every case where they were first published in any foreign State.

1. This injustice to the rights of intellect was at length partially removed for the first time in 1838. The Act then passed was repealed in 1844, by the 7 Vic. cap. 12, which enables Her Majesty, by Order in Council, to direct, as to books *and works of Art*, which shall be first published in any foreign country, to be named in such Order, that the authors of such books and works of Art, and their assigns, shall have the privilege of Copyright therein to be stated in the Order in Council, not exceeding that to which authors of similar works first published in the United Kingdom are entitled; but no such Order was to have any effect, unless it states that *reciprocal* protection has been secured by the foreign power, to be named in such Order, in favour of British Copyright Works. By this Act the benefits of, amongst others, the British Engraving and Sculpture Copyright Acts are extended and apply to such of the works named in the Orders in Council as such Acts shall be applicable to; but no such International Copyright was to be acquired, unless the work in respect of which it is claimed shall have been *registered* at Stationers' Hall within the period to be specified in the Order in Council.

2. In 1852, the 15 Vic. cap. 12 was passed, which recognizes a Copyright Convention then made by Her Majesty with France, and extended the Engraving Copyright Acts "to prints taken by lithography, &c."

3. All the International Copyright Conventions which have been entered into by the British Government stipulate "that no person shall be entitled to such protection as aforesaid, unless he shall have duly complied with the laws and regulations of the respective countries in regard to the work in respect of which such protection may be claimed." This stipulation applies to all descriptions of Copyright Works included in the Conventions.

International Copyright Conventions have been entered into by Her Majesty with the *eleven* following States, and in pursuance of the powers contained in the above mentioned Acts, Orders in Council have also been issued in accordance with such Acts and Conventions.

		Population.
1. With Prussia, in 1846 and 1855		17,202,831
2. Saxony, in 1846		2,039,075
3. Brunswick, in 1847		269,213
4. The Thuringian Union, in 1847		958,941
5. Hanover, in 1847		1,819,777
6. Oldenburg, in 1847		187,163
7. France, in 1851	36,039,364	
Colonies	3,506,218	
		39,545,582
8. Anhalt-Dessau-Coethen, and Anhalt-Bernbourg, in 1853		168,325
9. Hamburgh, in 1853		216,831
10. Belgium, in 1854		4,530,228
11. Spain, in 1857	14,162,219	
Colonies	4,528,633	
		18,690,852
Total population of these States*		85,728,818

I have already noticed that the Act of Parliament which authorises Her Majesty by Order in Council to enable *aliens* whose works are first published out of the British dominions to acquire Copyright there, expressly enacts that no such Order shall have any effect, unless it states that *reciprocal* protection has been secured by the foreign power, to be named in such Order, in favour of British Copyright Works.

It is a portion of the Prerogative of the Crown to enter into Conventions with foreign States. All those entered into by Her Majesty, as to International Copyright, expressly stipulate that from the date when such Convention "shall come into operation *the authors of Works of Literature or of Art*, to whom the laws of either of the two countries do now or may hereafter give the right of *property* or Copyright, shall be entitled to exercise that right in the territories of the other of such countries for the same term, and to the same extent, as the authors of works of the same nature, if published in such other country, would therein be entitled to such right, so that the republication or piracy in either country of any work of Literature or of Art, published in the other, shall be dealt with in the same manner as the republication or piracy of a work of the same nature first published in such other country; and so that such authors in the one country shall have the same remedies before the courts of justice in the other country, and shall enjoy in that other country the same protection against piracy and unauthorized republication, as the law now does or may hereafter grant to authors in that country." Also that the terms "works of Literature *or of Art*," employed as above, "shall be understood to comprise publications of books, of dramatic works, of musical compositions, *of drawing, of painting, of sculpture, of engraving, of lithography, and of any other works whatsoever of Literature and of the Fine Arts.*"

All the Orders in Council founded on these Conventions also recite that a treaty has been concluded between Her Majesty and the Sovereign of the foreign

* See the *Almanach de Gotha* for 1858.

State named therein, "whereby due protection has been secured within (such foreign State) for the benefit of authors of books, dramatic pieces, musical compositions, drawings, paintings, articles of sculpture, engravings, lithographs, and any other works of Literature and of the Fine Arts, in which the laws of Great Britain and of (such foreign State) do now or may hereafter give their respective subjects the right of property or of Copyright."

As to the Artistic Copyright Laws of the above-mentioned Foreign States.

Inasmuch as Orders in Council in favour of International Copyright are only legal when *reciprocal* protection is therein stated to be secured in favour of British Copyright Works within the territories of the foreign power mentioned in such Order, it would have been much more satisfactory if the Conventions entered into by Her Majesty had defined what works are the subject of Copyright within the territory of each of the States which is a party to such convention. What are "works of the Fine Arts" according to the laws of the *Foreign* States in question? Upon this point the Conventions contain no certain information whatever.

By Resolutions of the Diet of the Germanic Confederation literary productions of all kinds, as well as "*works of art*," are protected from multiplication, by any mechanical means whatever, without the consent of the author or his assignee of the *original* work. This general law as to Copyright is binding on all the States composing the Confederation, but does not appear to preclude them as sovereign states from making or altering their own laws of Copyright if not inconsistent with the Resolutions of the Diet.* The term of Copyright granted by the Diet is now extended to the artist's life and thirty years afterwards.† All the German States which have entered into Copyright Conventions with Her Majesty are members of the Confederation, and, with the exception of Prussia and Saxony, I cannot ascertain that any of them have any special law of Copyright.

The Prussian Code of Copyright, passed in 1837, has been eulogised by a distinguished French jurist as the most complete in existence on the subject.‡

As a legislative enactment it appears to be so; but it is by no means so liberal or just as the laws of France in favour of literary and artistic productions. The Prussian Code expressly prohibits the reproduction of *drawings* or *pictures* by engraving or lithography, coloured impressions, &c., &c. It also prohibits the reproduction of *sculptures* of all kinds during the period for which the Copyright is granted, and which remains the property of the artist so long as the original work belongs to him; but when the artist parts with his work, in the absence of any special contract with the artist to the contrary, the right passes with the possession of the original work.§ The term of Copyright accords with that granted by the Diet of the Germanic Confederation, namely, for the artist's life and thirty years afterwards.‖

The Saxon laws of Copyright also give a similar term of protection to artists in respect of the reproduction of their works.¶ The French *Code* on the subject of Copyright generally, and especially as to that which relates to works of Art, is of a very simple character; but a long series of decisions of the courts have gradually extended the meaning of the language of the Code, until it may be said to include not only drawings, paintings, and sculpture, but also engravings of all descriptions, and in all kinds of materials.* M. Rénouard, in treating upon the French laws of Artistic Copyright, says, "*Copyright* (*le droit de copie*) belongs to painters, designers, and sculptors in their productions, as well as the corporeal property of these productions themselves. That an artist may distinguish between these two rights; that he may sell his original picture, and retain the right to engrave or copy it; that he may sell the right to engrave and retain the proprietorship in the original; that he may sell these divers rights to different persons is what no one would for an instant doubt."† By a decree of 1852, it is declared that the piracy on the French territory of works published abroad, and mentioned in Article 425 of the Code-penal, shall constitute an offence; also the importation and exportation of pirated works generally. *Alien* artists, &c., therefore, now enjoy in France the same protection, in respect of their works, as if they were French subjects, although such works are not first published there. By a decree of 1793, amended in 1854, the term of Copyright granted in France is not only for the artist's life, but that of his widow, and also for the artist's children during thirty years from the death of their surviving parent; if the artist leaves no children, then it vests in his next of kin for ten years.

The Belgian laws of Artistic Copyright appear to extend to the same objects of Art as the French; but the utmost term of Copyright allowed in Belgium is for the author's life, and twenty years afterwards.‡

The Spanish law affords to painters and sculptors protection in favour of the reproduction of their works by engraving or any other process. This Copyright continues during the artist's life and for fifty years afterwards.§

By the Copyright laws of Germany, France, Belgium and Spain, as regards the productions of painters, their *pictures* are wisely made the primary objects of protection:—under the British Engraving Acts the *engravings* from pictures are made the primary objects. This radical defect in our laws can only be remedied by repealing all the existing Acts on the subject, and passing such a new and well-considered measure as will, at least, put our laws upon a footing of equality in justice with those of the foreign States who have entered into Conventions with her Majesty.

In conclusion, I will only add the following observations upon the existing laws of British Artistic Copyright:—

1. That they afford the producers of works of Art no sufficient protection against the piracy of their productions.
2. That the purchasers of works of Art are in the same position.
3. That in consequence of the defective state of our laws of Artistic Copyright, they afford a premium for the manufacture of piratical works.
4. And lastly, that the International Copyright Conventions entered into by Her Majesty, being based upon the principle of *reciprocity*, our defective laws are most unjust towards the subjects of France, and all the other States who have entered into such Conventions, because their laws afford British artists an amount of protection in favour of their works which far exceeds that which is obtainable by artists, either native or foreign, under the British laws of Artistic Copyright.

D. ROBERTON BLAINE.

Temple, 6th January, 1858.

* *Rénouard's Droits d'Auteurs*, vol. i. p. 280 et seq.
† *Blanc et Beaume's Code general de la propriété littéraire et artistique*, p. 222, et seq.
‡ *Rénouard's Droits d'Auteurs*, vol. i., p. 268.
§ *Ibid*, vol. i., pp. 272, 273.
‖ *Blanc et Beaume's Code general de la propriété littéraire et artistique*, p. 292.
¶ *Ibid*, p. 560.

* *Rénouard's Droits d'Auteurs*, vol. ii. pp. 78 et seq.
† *Ibid*. pp. 300 et seq.
‡ *Blanc et Beaume's Code general de la propriété littéraire et artistique*, p. 214.
§ *Ibid*. pp. 250, 251.

(B.)

Artistic Copyright Committee.

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C.
January 27, 1858.

Sir,—I have to request your attention to the resolutions below, passed by the "Artistic Copyright" Committee. This Committee has been formed by the Society of Arts in the hope that, by collecting facts, and by showing the mischiefs to which artists, and the purchasers of works of Art are liable, in consequence of the present defective state of the laws of British Artistic Copyright, Parliament may be induced to amend those laws. The Committee will be obliged by your early attention to the enclosed questions. In answering them it is suggested that you should *omit the names of persons* connected with the facts you state; you are also recommended to confine yourself to circumstances within your own knowledge, not giving those derived from the information of other persons.

The Committee request the favour of a reply not later than Thursday, the 4th of February.

I am, Sir, your obedient Servant,
C. L. EASTLAKE,
Chairman of the Committee.

Resolved, That the inquiries of this Committee be directed,—

1. To ascertain the existing laws of British Artistic Copyright, and the chief defects of those laws.
2. How those defects affect the interests of producers of works of Art.
3. How they affect the interests of purchasers of works of modern Art.
4. How they affect the interests of the public and the promotion of the Fine Arts.
5. How they affect the subjects of those foreign States with whom Her Majesty has entered into International Conventions; and what the laws of those States are as affecting Artistic Copyright.
6. To obtain instances of fraudulent or wrongful acts relating to works of Modern Art.
7. And lastly, to suggest such remedies as appear best calculated to amend the defects of our Artistic Copyright laws.

By order,
P. LE NEVE FOSTER,
Secretary.

(C.

Society for the Encouragement of Arts, Manufactures, and Commerce.

The Artistic Copyright Committee.

1. When the pictures of British artists command good prices, is it a common practice that *spurious* copies of such pictures are made?
2. Are such spurious copies usually made of the same size as the original pictures, and as closely as possible to resemble them?
3. Where the original picture has been *signed* by the artist, is it a common practice to imitate or add such signature upon the spurious copies of it?
4. Do you know, and will you state, any instances where spurious copies of pictures have been shown to you for your opinion thereon; or have been sold, or offered for sale, or exchange, as *original* pictures?
5. Did the persons so selling, or offering for sale or exchange, such spurious copies know them to be so? or had such persons, in your opinion, reasonable cause for believing them to be spurious copies?
6. Do you know, and will you state, any instances where artists have, at the time of selling their pictures, expressly reserved their Copyrights therein for the purposes of engraving, and yet have subsequently been deprived of the profits of such Copyrights; and how were they so deprived thereof?
7. Do you know, and will you state, any instances where artists have *not* reserved their Copyrights when they sold their pictures, and where the proprietors thereof have either sold the Copyrights for the purposes of engraving, or gratuitously allowed them to be engraved without the consent of the artists who painted them, and without giving them any remuneration for the Copyright?
8. Do you know, and will you state, any other facts which in your opinion are calculated to promote the objects of this Committee, as shown by the resolutions sent herewith, either as relating to works of sculpture, architectural designs, pictures, drawings, sketches, engravings, or photographs?
9. Will you suggest such alteration of our existing laws of Artistic Copyright as, in your opinion would prevent the continuance of any and which of the grievances to which the present state of such laws now exposes sculptors, architects, painters, engravers, publishers, and purchasers of works of Modern Art; and would likewise tend to the promotion of the Fine Arts in the British dominions?

(Date and Address.) (Name.)

N.B.—The spaces left as above are for your answers. If not sufficient, you can write them upon a separate paper, numbering each of your answers to accord with the number of the question. In answering these questions it is suggested that you should omit the names of parties connected with the facts you state; you are also recommended to confine yourself to circumstances within your own knowledge, not giving those derived from the information of other persons.

SIXTEENTH ORDINARY MEETING.

Wednesday, March 24, 1858.

The Sixteenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 24th inst., Joseph Glynn, Esq., F.R.S., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Bowley, Robert Kanzon	Paule, Joseph Michell
Brooks, Shirley	Rider, Joseph
Dyce, William, R.A.	Thorman, Edward H.

The following Institutions have been taken into Union since the last announcement:—

457. East Lancashire Union.
458. Selby Mechanics' Institute.

The Paper read was:—

ELECTRO-MAGNETISM AS A MOTIVE POWER.

By Thomas Allan.

It is superfluous to enumerate the many material advantages electro-magnetism has over steam, from its great simplicity, compactness, constant power at all velocities, and being entirely under control. With no reservoir of danger as in the steam-boiler,—always ready for action, without previous consumption of materials, as in getting up steam,—and no waste in freightage, as in carrying coal.

The two points to solve in the use of electricity as a moving power are its application and economy.

Hitherto, every application of electro-magnetism that has been put to a practical trial has been at variance either with the laws of electricity or mechanics.

It, therefore, now only remains to be shown, that electricity, the *most powerful agent in nature*, by an application in *conformity* with its known laws and properties, can be rendered available as a motive-power.

The power of electricity, when applied in the form of an electro-magnet, is wonderfully great from comparatively small means; but its dynamic effect decreases so rapidly through the intervening space, being "inversely as some unascertained power of the distance much higher than the square," that the range of the maximum effect or valuable portion of the dynamic force, with a consequent minimum of consumption, extends to so small a distance as to be of no real value in mechanics. The great problem to solve has been to contrive such an arrangement of parts as to convert this maximum of the dynamic effect, through a range, although unavailable in itself, into *stroke*, or such an extent of motion as to be available and of practical value as a motive-power.

In the plans and arrangements of these inventions, the maximum portion, only, of the dynamic effect, is applied, and by the mechanical arrangement of parts, is successively and continuously brought into action in a direct form, in accordance with the laws of electro-dynamics. When thus applied, there is no loss of the primary electric force, and any amount of *power*, and any *length* of *stroke*, can be obtained.

The cost of electro-motive power has generally, though erroneously, been considered so great as to render electricity as a motive-power less profitable than steam. But this has arisen from the misapplication of the electro-magnetic force, not from the necessary consumption of the electric materials, which consumption is inversely as the dynamical ratios of the force.

The introduction of electro-motive power, will be an event of great national importance, tending to alter the value of every article of commerce and manufacture, as steam has done since its adoption.

It is a due consideration of the foregoing summary of a most interesting and important problem in physical and mechanical science, still progressive, that forms the subject of the present paper; and although the final solution is still to be worked out, I will endeavour to detail some of the obstacles, as well as the *modus operandi* entered upon, so far as they have progressed, to effectuate the same.

Notwithstanding the evident vastness and importance of this subject, and the enlightenment of the present age, it is not a little curious to observe with what stubborn resistance and discouragement any such invention or innovation upon vested rights or the routine of bye-gone years is hailed. Electro-motive power, *par excellence*, seems to meet with fully more incredulity and disbelief in the mind of man now than steam or gas did in their first days. To mention the subject even seriously is to be considered next thing to a lunatic, and the signal to have raised against one, a barrier of apparently insurmountable difficulties, the fancies and jealousy of vested interests, the disappointments of various crude and empirical attempts, to say nothing of the dogmas of some professors of a sister science. Some such, with minds of but small powers of philosophical conception, are too apt, with unbecoming flippancy, to crumple up a whole question with a wizard-like *ipse dixit* of impossibilities as to cost, based on anomalous and untested assumptions.

Professor Liebig, in his "Familiar Letters," goes much out of his way to run a tilt against electro-motive power, and patronisingly remarks "that electro-magnetism as a motive-power is engaging great attention and study; wonders are expected from its application to this purpose; such expectations may be very attractive, indeed, they must be so, otherwise no one would occupy himself with them, and yet they are altogether fallacious; they are illusions depending on the fact that those who entertain them have not made the necessary comparisons and calculations." He then reminds his readers "of what chemists denominate "equivalents," and likewise that zinc in the battery is burned (oxidised), a consequence of which action is the production of an electric current." We are then informed that "out of nothing no kind of force can arise," and "if we were to burn the zinc under the boiler of a steam-engine, consequently in the oxygen of the air instead of in the galvanic pile, we should produce steam and get a certain amount of force," but that "we must still recollect that zinc can be represented by an equivalent weight of carbon (as coal), so that, according to the experiments of Despretz, six pounds weight of zinc, in combining with oxygen, develope no more heat than one pound of coal, consequently, under equal conditions, we can produce six times the amount of force with a pound of coal as with a pound of zinc." There is in all this no small amount of confusion of ideas pegged upon the experiments of Despretz which cannot fail to mislead, having nothing to do with the mechanical force of magnetism produced by a given amount of current electricity.

It is a most unfortunate doctrine, but also a practical absurdity, to state that zinc cannot give out more power than the coal required to melt it. Doubtless a given amount of zinc, combining with oxygen, would not eliminate more heat than would overcome that affinity, but there is no such relation of heat to electricity as to make the mechanical power of the one the measure of the mechanical power of the other. Whatever may be the analogy between heat and electricity, they must be considered as distinct forces in their mechanical relations. In the combustion of coal, heat only is the motive-power developed, whereas in the oxidation of zinc in the battery, both heat and electricity are developed, the latter only being the motive force.

Prof. Page, on this subject, remarks, "The absolutism of forces regulating affinities may be interesting as a matter of speculation, but as furnishing a practical estimate for the amount of mechanical or available power, it cannot stand, and necessarily involves the unwarrantable assumption that the whole power or inherent force may be eliminated and rendered available in each case." But Liebig goes still further. He maintains that the heating power of the current is the equivalent of the mechanical power through electro-magnetism, or, in other words, that the heat developed by the passage of the current, ought to raise steam enough to furnish a power equivalent to the electro-magnetic power of the same current, and from the fact that the mechanical force derived from the steam raised by the heating power of the current is so small, compared with that obtained by the combustion of coal, he arrives at the conclusion that electro-magnetic power "can never be used."

The cost, however, of such a power is but a subordinate question, as other and more important points have to be settled first, before the cost can be fairly ascertained.

The speculation is thus pushed up to a point where facts are brought to bear upon it, and fortunately where facts enough can be adduced to subvert the whole doctrine.

Desiderating cause and effect, and taking a practical survey of the whole subject, the problem appears to resolve itself more into one of mechanics and mathematics, than of chemical equivalents, for, let the cost of a given amount of electricity be what it may, we must see how that is to be economically applied to produce magnetism, in the first instance, and, again, how the dynamic effect of magnetic attraction is to be applied to machinery in accordance with its known laws, and that, too, to produce such an amount of motion or stroke as will be available to motive machinery.

It is to this end, then, that those who choose to think for themselves are not turned aside from the investigations of such a subject by the various discouragements thrown in their path, but, heedless of the dried leaves of theory of those who, without the comparative anatomy

of thought, beg the question, seek to apply the dynamic effects of magnetism to machinery.

The power exhibited by electro-magnetism, though very great, extends through so short a space as to be practically useless in mechanics. A powerful magnet might be compared, for sake of illustration, to a steam-engine, with an enormous piston, but with an exceedingly short stroke, (*per se*) unquestionably a bad arrangement, or, rather, no arrangement at all, yet, if such mechanical arrangements could be devised, so as to take advantage of this enormous piston, and, at the same time, to produce stroke, without militating against that power or increasing consumption, then we would have a machine containing the elements of power and motion, without which the question of the cost of producing the electricity and, still more, its application to produce magnetism, are irrelevant and secondary in the first stages and practical investigations as to producing power and motion in a machine by such agency.

It has, consequently, appeared to me that in working out this problem it should be considered in three distinct parts.

First. How to apply the force of magnetic attraction economically in a machine, taking advantage of its maximum force only with a consequent minimum of consumption, and continuing that power to any length of stroke required.

Second. How to establish the right proportions between a given amount of electricity and the length and diameter of a magnet, so as to produce the maximum of magnetic effect with the minimum of electrical consumption.

Third. The economical production of electricity and working of the battery.

Before going into any questions of application, it would be profitable to inquire into the peculiarity of the forces about to be dealt with as a guide, to the mechanical arrangements necessary to produce motion and power, with economy in consumption.

The static force of magnetism is, to the casual observer, something immense from apparently very small means; whilst the dynamic effect, which is what we have to deal with, and render available as a moving power in mechanics, is a force peculiar to itself, and differs from all others we have in nature, and therefore requires to be considered *per se*, without reference to, and regardless of, other forces as applied to motive-power.

The dynamic effect of magnetic attraction decreases in the inverse ratio of the squares of the distances, as will be seen if the geometric curves of that force be drawn, measured from some focal point within the surface of the magnet, and as the consumption of zinc in the battery by the electricity so produced is in accordance with the time taken for the attracted body to pass through a given space, it follows that at a certain distance from the magnet where the force produced is least the consumption is greatest proportionately, and on approaching the magnet where the force is greatest, the consumption is least; in a working engine, going at an even speed, the time being equalised, the consumption for each distance passed through would be the same; it will, therefore, be sufficient as a question of economy, to consider the time for equal spaces passed through, as equal, although of the attractive force of itself without a resistance, it may be said, however paradoxical it may appear, that the force, and therefore the velocity, being inversely as the squares, the consumption must be inversely as the forces.

The curve of dynamic effect drawn from the surface, and the calculations of the squares also, shows that if a magnet at an inch distance will sustain a weight of one pound, at half an inch it will hold four; at a quarter, sixteen, and so on. If this curve be further carried out, and the whole distance or range of attractive powers divided into tenths; the sums representing the means of the forces through each increment or tenth of the whole distance respectively, showing that if the mean force of the tenth nearest the magnet be 1,000 lbs., that of the tenth furthest off will only be 3 lbs., and, as we have shown before, when the keeper or material to be attracted, moves at an even speed (as in an engine in motion), there would be as much consumption of electricity and consequently zinc to produce the 3 lbs. of power, as to produce the 1,000.

Calculating the dynamic effect from the surfaces of the magnets, by the laws of the squares inversely, is only an approximation to the ratios of decrease in the dynamic effect, for, as before mentioned, the forces of attraction must be calculated from some focal point within the surface of the magnet, depending for its position on the length and diameter of the magnet —this unknown point is easily ascertained, whence the mean dynamic power of that portion of the magnetic attraction that has been arranged to be applied and utilised in the engine can be measured and ascertained—so as to calculate the theoretical horse-power of the engine.

In the arrangements adopted to utilise these peculiar forces economically, and likewise obtain stroke, it was necessary, to this end, to form magnets with 4, 6, or 8 poles screwed on flat plates, so as to apply the attractive force in a direct form, and thus by the very simple arrangement of a piston rod passing through the centre of this group of magnets, in a line at right angles to their plane a keeper resting on a shoulder on the piston rod would meet the surface of the magnets in a plane parallel to itself; the keeper thus not only embraces the full sphere of magnetic attraction, but, by such an arrangement, as the force of magnetic attraction decreases so rapidly with the distance, it is not economical to utilize or apply more than that portion of the attractive force that is most effective, and so not expend the electricity on that which inversely, as the squares, is comparatively of little value, and only produced with a larger proportionate expenditure.

In this arrangement, when the first magnet in the series has, by attracting the keeper, operated on the piston rod, the stroke or onward motion of the rod is continued by a similar operation of the second magnet placed below the first, and so on with the third and fourth. The onward motion of the shaft is then continued by a second rod on a second crank in like manner to the first, and so on by a third and fourth.

It will thus be seen that the motion is continuous, not reciprocating, analogous to the overshot water-wheel —each magnet coming into play one after the other— and that it is that portion of the magnetic attraction only which, proportionately to the power obtained, consumes the smallest amount of electricity, and consequently of battery consumption, that is applied as a motor in engines constructed on these principles. It will not be difficult to perceive by the foregoing how the great and most important results of the whole problem, viz., the economics, may be completely counteracted by a misapplication of this peculiar dynamic effect, whatever it may have cost to produce it; and to illustrate this more clearly, a comparison might be made between the principle of application in the rotary engine (Jacobi's) and the present arrangements. The rotary engine has hitherto been the most favorite form among the various experimental appliances in electro-magnetism as a motive power, but in this mode of application, besides a variety of electrical disadvantages, it will be easily seen, having to apply the attractive power in a slanting direction, in place of direct, that there is of necessity a great waste of the magnetic force, that it is the upper portion of the curve only that can be applied effectively, whilst as the magnet has to be demagnetised in time to allow the keeper to pass, the maximum of the force has to be abandoned. On the other hand, in the present arrangements, the application being direct, it is the maximum only that is utilised.

To carry out the comparison still further in the rotary system, about 8-10ths only of the dynamic curve can be

made available, the eight upper sections as against the two lower in the present system, where attraction is direct. This would give in the former a mean force of 12 through a given space, as compared to 555 in the latter, with an equal consumption of electricity, making a difference in cost as to the power utilised as 46 to 1, and even supposing the rotary system could be practically worked so as to utilise 9-10ths of the curve, the ratio of cost would still be in favour of the latter as 24 to 1.

Theoretically, this would be a great stride in the right direction as to cost, and almost conclusive, if we could depend on a statement in a paper of Mr. Hunt's to this Society some years back, that electro-magnetism as a motor was impracticable, the cost being in an engine on Jacobi's principle a hundred-fold as compared with steam. Upon this showing, so far as the utilization of the magnetic curve goes, all else being equal, the relative difference in cost of steam and electro-magnetism as a motor becomes reduced to something within reasonable bounds.

In the second part of the question, as to the proper proportions of parts so as to produce the maximum of magnetic effect with the minimum of electrical consumption, there is much still to be investigated, as there seems to be no law yet worked out that would be a true guide on this subject. I have given much consideration to this point, and have obtained many practical data toward the great question at issue.

As an instance of misapplication of current force, I may mention an extreme case, indicating by comparison, great consumption or waste and little effect. A magnet with an electrical consumption of 352, gave out a supporting power of $2\frac{3}{4}$ cwt., at half-an-inch distance from the surface of the magnet, whilst another with the same battery, and a consumption of 512 (owing to the shortness of the circuit) only gave out an attractive power of 48 lbs. at the same distance. In another case, where two magnets of different diameters and circuits consumed exactly the same amount of electricity, the one gave out an attractive force at a certain distance of 97 lbs., where the other gave 476 lbs. at the same.

These two cases, although extreme ones, clearly show where the important question of cost, to a certain extent, lies, and that, without complete investigation, and the establishment of well-defined data, as to proportions relatively, so as to produce the maximum magnetic effects with the minimum of electrical consumption, the economics of the question, as regards this section of it, will still be a varying quantity, and, as hitherto, greatly left to chance.

In the third portion of the question, viz., the economical production of electricity, it may with safety be remarked that, with all its improvements, the battery is but a clumsy affair; what, then, may we not expect from a series of scientific researches into the as yet undeveloped secrets of this marvellous element.

It must be obvious, from the foregoing, that, as I stated at first, electro-magnetism as a motive power was not simply a question of chemical equivalents or of producing electricity cheap, but more essentially to ascertain the economical application of it to produce magnetism, in the first instance, and then to contrive such an arrangement of parts as will produce stroke or motion in a machine along with an economical application of that force when so produced. It, therefore, follows that, without a properly combined investigation of these three questions as a whole, and an application of forces in accordance with their known laws, it would be but a waste of time, barren of results, as appears to have been the case hitherto with many expensive experiments made in various countries, disregarding this triplicate application of dynamics in mechanical and physical science.

I have not in this paper entered into the mass and minutiæ of detail, as only tending to confuse, and other obstructions that yet stand opposed to ultimate and complete success, but have treated the subject generally, and as a progressive one, so as to bring out with as much force of character as possible the broad features of this interesting problem, and the main principles of the applications of the forces by which it is ultimately to be solved.

I have only now to repeat what I started with, that "hitherto every application of electro-magnetism that has been put to a practical trial, has been at variance either with the laws of electricity or mechanics," and also, that "the power of electricity, when applied in the form of an electro-magnet, is wonderfully great from comparatively small means, but its dynamic effect decreases so rapidly through intervening space, that the range of the maximum, with a consequent minimum of consumption, extends to so small a distance as to be of no real value in mechanics; the great problem to solve is how to contrive such an arrangement of parts as to convert this maximum of the dynamic effect through a range, although unavailable in itself, into *stroke*, or such an extent of motion as to be available and of practical value as a motive-power."

Confident, therefore, that the principles on which the mechanical and physical applications of the electrical and magnetic forces are based, and as enunciated in the foregoing, to obtain the elements of motion and power in a machine by such agencies, are correct, in fact, having not only hit upon the right principle, but laid the foundation for its adoption, I feel every incentive, and a strong impelling power besides, to carry forward such investigations, despite all discouragements, feeling assured that the difficulties in details will, in due time, yield to further knowledge and experience of the phenomena of the peculiar forces under investigation, so as to render electro-magnetism as a motive-power a practical and useful agent in the various works of man.

We have witnessed the great revolutions effected by steam within the last forty years, both on sea and land; it is an agent continually advancing, exercising incalculable influence on the wealth, and not less decidedly on the moral progress of nations—in one word, contributing to the march of civilisation throughout the globe—furnishing the apt illustration of the oft-repeated adage, "Knowledge is power." Rapid as have been the advance and expansion of steam-power, with its manifold applications to the wants of mankind—remarkable as its progress may still be, it cannot be disguised that a new motive power is perhaps the great desideratum at the present stage of mechanical science. There is a growing want felt; the requirements that have been mainly evolved through steam itself having apparently outstripped the agency that has called them into being.

The introduction, therefore, of electro-motive power—its bearings upon all questions of commerce, manufacture, and civilisation at home and abroad, opens up to the contemplative mind of the political economist a wide field of speculation, and becomes a question of great national importance, tending as it must to further alter the relative value of every article of commerce and manufacture as steam has done since its introduction.

If, then, with electricity, we can produce motion and power in a practical and useful form, and so carry forward for the benefit, advancement, and civilisation of mankind, that good work so happily commenced by steam, what a grand problem would then be solved.

The unphilosophical manner in which some people allude to electro-motive power superseding steam, is of a nature greatly to excite prejudice against a due consideration of the political economy of such agencies. Common sense, and a proper deference to the philosophy of common things, indicates that electro-motive power will no more supersede steam than steam the water-wheel, as each and all have their own field of operations and functions to fulfil peculiar to themselves; the cost, the power, and the various advantages of either being relative to the requirements of their respective applications as motive forces.

It will suffice to give a brief sketch of some of the many advantages such a motive-power has over steam. A motive-power without fire at once stamps it with peculiarities due to itself alone, and indicates a field of operation in which it can have no competitor. It can thus be applied, where the cost of insurance precludes the use of a steam-engine, such as the hoists in the large Manchester warehouses, where they have not been built on purpose. There are also a variety of other instances where a small engine may be used, as in each flat of a mill, thereby getting rid of all the communicating gearing, the first cost of such gearing, the power to work the same, as also the saving when the mill was working half time, the dinner hour, and in getting up steam. Its application, likewise, as a small power, to house and workshop purposes in town and country, where steam does not venture to intrude as yet, or is entirely disallowed, for various reasons besides fire and the cost of insurance. England, with its cheap fuel, might at first sight appear as the most barren field for its operations; but from its apparent completeness as a small power, it becomes applicable as an auxiliary agent, in a host of conditions where steam is quite inapplicable; it may be said it has a wide field of operation peculiarly its own; as a small power, there is no reason to suppose that it is inapplicable to larger powers; although it might be rash in its present state of infancy to predicate what its future might be; for, as applied to locomotion, and as an auxiliary screw in our large merchant ships, there is a great point to be gained that is but partially attained by steam; one other value in the applications of such a power is as a species of division of labour, as when it will suit the requirements of the case instead of being combined into one large engine, as in the steam-engine, it may be applied as several smaller ones and thus the power be brought close to the work and not lost in the friction of transmission from a distance. It would be endless to point out the various conditions where such a power would be applicable; this is best left to the mind of each man, in his own particular sphere of mechanics, and doubtless each will, in his own way, see a useful application of such a power, when the management of the battery, &c., is reduced to that simplicity, that the man of the many can work and manage it as well as the man of the few.

Looking to the political economy of such a question as that of a new motive power, it is not surprising, notwithstanding the scepticism of empirical philosophers, that one should become an enthusiast in such a cause—feeling that the obstructions thrown in one's way are mere blocks of granitic ignorance to be hewn and removed aside by patience, perseverance, and investigation into the nature of things.

The new-born science, though still but little known, is gaining on us fast, and advancing with rapid strides into the business of every-day life.

In conclusion, it will be obvious how directly and immediately the application of this power could be traced to the physical principles before enunciated. It is one of the numerous instances in modern times in which physical philosophy has found an immediate practical result in the labours of investigation.

We must not, however, be too elevated with such achievements, for the triumphs of science should be ever regarded as manifestations of the working of a higher Providence, turning the development of new powers to the wants of mankind, and showing that as He has willed man's progress, so also He prepares the instrumentalities by which it is brought about.

DISCUSSION.

Mr. Hearder said he had listened to the admirable paper of Mr. Allan, with greater pleasure, perhaps, inasmuch as some fifteen or twenty years ago he was as great an enthusiast on this subject as Mr. Allan now appeared to be. It would, perhaps, be hardly fair to ask Mr. Allan the proportion which the power in the machine exhibited bore to the amount of electrical agents expended to produce that power, or the absolute amount of power which his machine was capable of developing. He would briefly remark upon some of the principles laid down by Mr. Allan, which to his (Mr. Hearder's) mind appeared as rather taken for granted than absolutely proved. Mr. Allan had stated that the magnetic attraction acted inversely as the square of the distance through which it operated. He (Mr. Hearder) did not know of any such law under the arrangements described by Mr. Allan. He knew that when a single magnetic bar was used, and a bar of soft iron was approximated to the end of it, the law described by Mr. Allan would be developed. The peculiar condition in this case was that the bar was capable of undergoing induction, without which attraction could not take place. If a single transverse section of the soft iron bar were cut off, for instance, like a wafer, and applied with its face to the end of the magnet, it would be scarcely attracted at all, and no such law would be discovered, the attraction even varying simply as the distance. But turn the disc, and apply its edge to be attracted by the magnet, and the attraction increases in a very considerable degree, simply in consequence of its length permitting inductive action to take place. But even here the law of the squares of the distances is not developed until the bar is of such a size and length as to admit of the greatest amount of induction. Therefore thick keepers were required with magnets of great power. With regard to the law of the squares, as connected with the horse-shoe magnet, if a piece of card be inserted between the keeper and the magnet, and the attraction force be ascertained, it will not be found that the insertion of two pieces of card will reduce that force to one-fourth; three pieces one-ninth, and so on. In all cases where attempts had been made to develop the law of the squares, it had been necessary to assume a focal point within the magnet, but after all, practically, the only available working space was that between the keeper and the end of the magnet, and it was to the variable conditions existing in the space that experimental inquiry should be directed. Most present were familiar with the name of Hjorth, of Copenhagen, in connection with this subject. That gentleman had lately constructed an electro-magnet of large size and considerable power on which he had experimented, and the result had disproved the truth of the law in question. He had indeed succeeded in obtaining an attractive power of some hundred pounds, at a distance of upwards of three inches. Between the two poles of a magnet there existed a mutual attraction, and the magnetic lines of force might be shown by the arrangement of iron filings on a screen. When a keeper was brought within a certain distance, these lines of force altered their direction, and were then concentrated on the keeper. On withdrawing the keeper to a greater distance, it would be observed that these lines of force were again changed, a portion of them leaving the direction of the keeper and acting between the poles of the magnet. The decrease of magnetic action upon the keeper in relation to its increased distance was thus curiously shown. If, however, the experiment was tried with another magnet, whose poles were at a greater distance from each other, the lines of force would be seen to assume a different direction at different relative distances of the keeper, and the direct magnetic action between it and the magnet would be maintained throughout a greater distance. Therefore, in all these experiments it was necessary to bear in mind the dimensions of the magnet and the distance between its poles. He was sure Mr. Allen would accept these few remarks in the friendly spirit in which they were offered, although they might not coincide precisely with the opinions he had expressed in his paper. Mr. Allan, like many others before him, had taken for granted certain laws which had been apparently well defined, but which he (Mr. Allan) had not ascertained

for himself. He (Mr. Hearder) had fallen into the same error himself long since, and had been obliged to work out the problem for himself. He would remark that iron was only susceptible of a certain amount of magnetisation, and that magnetic development in iron, when high intensities were obtained, did not keep pace with the increments of electrical agency. He had ascertained these facts more than sixteen years since by the use of his (Mr. Hearder's) magnetometer, which had enabled him to determine the due proportion between the bulk of a magnet and its intended strength. He would conclude his remarks by hoping that Mr. Allan would pursue the subject with the success his talent and energy merited.

Mr. E. HIGHTON said he thought the Society was deeply indebted to Mr. Allan for his paper. At the same time he regretted that it did not contain any account of some of the most important elements essential to the use of electro-magnetism as a motive power. He was sorry to find that the author had omitted entirely to state the horse-power of the engine exhibited, and the kind of battery employed, the number of cells, the kind of metals and acids used, the distance between the metals, the length and diameter of the electromagnets, and the size and length of the wire surrounding them. He considered, without these facts being given, it was impossible to compare Mr. Allan's engine with those of other persons. He remarked, also, that one of the most important elements in the question had been entirely omitted, viz., the fuel consumed per horse-power, and its cost. Had such been given, a true comparison might have been drawn between the cost of steam-power and electromotive-power. He considered that, for motive-power of any kind, the materials found naturally in the earth should be used for consumption, or change of state, and not a manufactured article, such as zinc and acids, which must always be dearer than natural products. He compared the requirements of the steam-engine with those of the electro-magnetic engine. He observed that in the steam engine the materials employed to produce power were natural products of the earth, viz., coal and water, the latter costing little or nothing; whereas, in the electro-motive engine, the materials employed for producing power were all manufactured, and, therefore, much more expensive. He contended that the attention of parties advocating electricity as a motive power should first be directed to the discovery of some natural products of the earth to produce the electricity required, rather than to the form of machinery to convert the power developed to useful purposes. At present the cost of producing such power was a barrier against its use. He concluded by saying that he thought the thanks of the meeting were due to the author of the paper for his having brought the subject before the Society.

Mr. SIEMENS observed that the problem of applying electro-magnetism as a motive force had engaged the serious attention of natural philosophers ever since the time of Oersted's great discovery of electro-magnetism itself. The great force with which an electro-magnet resisted separation from its armature, naturally led to inquiries whether that great attractive force could not be made to act through a sufficient space to impart motion to a crank or other mechanism. The result of these researches—which had been conducted by some of the most able electricians, regardless of labour and expense—had been invariably the same, viz., machines working with great facility and speed, but of exceedingly small force compared to the consumption of zinc and acid in the battery employed. The knowledge of the nature of electricity, and of its natural relation to chemical action, heat, and dynamical effect, had been greatly advanced however in late years, and had furnished a general solution of the questions put forward by Mr. Allan. The power that could under the most favourable circumstances be developed by the combustion of a given amount of zinc in a battery, or of coal in a furnace, was proportionate to the amount of oxygen absorbed; but it so happened that a ℔. of zinc absorbed only 6 measures of oxygen, whereas a ℔. of carbon took up 33 measures in forming oxides. But carbon, when properly burnt, took up two equivalents, or 66 measures of oxygen, which gave it the advantage over zinc in the proportion as 66 to 6, *i. e.*, 11 to 1. Taking the cost of coal at £1 per ton, and that of zinc at £27 per ton, it followed that power produced by a perfect electro-magnetic machine would cost nearly 300 times more than the same power produced by a perfect caloric or steam-engine. It must, however, be remembered that neither the present steam-engine nor the best electro-magnetic engine ever produced, realised anything like the full theoretical result; but it could be shown that the relative loss of power in the electric engine was much less considerable than in the best steam-engines of the present day, and that consequently the latter left the greater margin for future improvements. Mr. Allan had met the theoretical objections to his engine by an indirect argument. He said that if the power produced bore a certain proportion to the electric current expended, then the attractive force of the electro-magnet upon the armature should be the same when in greater or less proximity to each other, where experience proved that the attractive force increased rapidly inversely as the distance, while the expenditure of the current remained the same. To his (Mr. Siemen's) mind, this only proved that there was a great waste of current (in addition to the necessary expenditure) when the armature was at some distance from the poles of the electro-magnet, and did not at least affect the theoretical question. With regard to the mechanical arrangement of the machine brought forward by Mr. Allan, he (Mr. Siemens) observed a serious loss of power that resulted from the sudden stoppage of the armatures in their descent. Mr. Allan produced, by this arrangement, much useless sound instead of useful mechanical effect. Mr. Highton had alluded to the possible employment of substances less costly than zinc for the production of electric currents. If such substances could be discovered in nature, he Mr. Siemens) admitted that the electro-magnetic engine might supersede the steam-engine for many purposes, but, in looking around him, he could not discover any substance in nature at all likely to answer the desired purpose, except it be coal itself. The substance in question must necessarily be simple, so as to be capable of combination with oxygen or other simple elements; but all things in nature were found in a combined state except the precious metals—sulphur and coal—(which might be taken for pure carbon for the present purpose). All these substances were remarkable for their repugnance to oxidation at the ordinary temperatures, and if carbon should ever be made suitable to take the place of zinc in an effective galvanic battery, it must be at very elevated temperatures. The liquids employed in such a battery would, probably, have to be salts, in a state of fusion instead of solution. It would, of course, be impossible to say whether a battery of such a description could ever be made available, but he (Mr. Siemens) felt convinced that the only chance of producing a practical electro-magnetic-power engine consisted in improving the means of obtaining the electric current, rather than in the mechanical contrivances for utilising it.

Mr. HENLEY said he had expended many hundreds of pounds of his own money, and several thousands of other people's, under various patents, in the prosecution of this subject, but he had never yet seen anything in the electro-motive power that could at all be brought into comparison with the steam-engine. He had made a magnet which would sustain the weight of 15,000 lbs.; but when the keepers were placed three or four inches from the magnet it would not exert a force of more than four or five pounds, and the cost of obtaining about half-horse power with such a machine was nearly £5 per day. He was, therefore, sceptical as to any practical advantages from the application of this principle. He might say that the machine exhibited that evening was

the best he had ever seen. It would certainly be very advantageous for purposes where steam could not well be employed, and no one would rejoice more than himself to see it successfully carried out.

Mr. LAWRENCE would have been glad to have heard more from Mr. Allan as to the cost of working these machines, as that was, after all, the important practical part of the question. It would appear, from the statement of Mr. Siemens, that the cost, as compared with steam, was as 300 to 1; and, at that rate, to drive a locomotive engine by magnetic power, instead of costing 6d. per mile, as at present, would give a cost of somewhere about £15.

Mr. NEWTON said some twenty years ago, a machine, worked by electro-magnetic power, was sent to the house with which he was connected. It was upon the rotary principle, but, being a small and somewhat rough model, it did not work very well. There was, however, a certain amount of power got out of it, and, bad as it was, it satisfied him that there was a power to be obtained if effectual means could be discovered of developing it. A hundred years ago, the application of steam as a motive power was very little known, and it was the genius of Watt and Stephenson which had developed the capabilities of that power to its present enormous extent. He was much pleased with the machine exhibited that evening, and he thought a step had been made in the right direction. The observations of the various speakers applied rather to the cost of working than to the mechanical arrangements, and he thought that consideration had been too closely mixed up with the subject. He considered the first object was to find out the means of applying a power which was known to exist, and when that was accomplished attention might then be turned as to the best means of obtaining that power. The same objections were raised against the electric light when it was first introduced. The apparatus brought out at that time was very ingenious, and accomplished all that was required with the exception of cost. It was the same with the machine before the meeting. He thought the two questions ought to be kept separate from each other. First let the fact be established that such a motive power did exist, and he believed that genius and science would find out the means of supplying it at a cost which would render it practically useful.

Mr. WILLIAM HAWES thought it was one of the first duties of this Society to encourage the exhibition of machinery—no matter how novel or at what cost it was worked. Although he was one of those who thought that the machine before the meeting was no practical advance upon what was known before, still the exhibition of such a machine, and the new ideas it gave rise to, tended to promote progress. He felt bound to say he did not think that, in the present instance, success was likely to result from the talent and money expended upon these attempts. It had been properly described as a question between steam and electricity. Mr. Allan had pointed out the advantages of such machinery in situations where fires and steam-boilers were not admissible, but in looking at the machine before them, the apparatus outside the room must not be forgotten. The large batteries required to give motion to the little machine must not be overlooked. Let a comparison be made between the materials composing those batteries with the cheap and readily obtained materials (coal and water). with which a steam-engine of ten times the power of the engine before them and occupying hardly more space, could be worked. He thought it wrong to pay compliments to any one who he believed was pursuing a mistaken course. He did not wish to throw any discouragement in the way of Mr. Allan, but how little progress had been made in the application of this power, notwithstanding the attempts which men of science and genius had made for the last twenty years. The case was analogous to that of the electric light. Improvements, no doubt, had been made in the production of it, but it was still only available where cost was no object. It could not be used for street lighting or domestic lighting. Still that was all the progress that had attended the researches and labours of some of the most eminent men of the age for many years past. He believed the great duty of mechanics in general, and of this Society in particular, was to encourage—not complicated machinery, but to cultivate the most simple forms, and the adaptation of the most simple elements, and those marked out by nature as the cheapest and most easily convertible to their use. He should prefer to see Mr. Allan devoting his great abilities to some more practical and useful subject than that now before the meeting would, in his opinion, ever prove.

Mr. SPENCER said, looking back at the slow progress which had been made during the last 100 years in the development of the great agent, steam, he was not without hope with regard to the subject before the meeting. He thought pioneers of every great discovery deserved encouragement, and he had no doubt whatever that what had been exhibited that evening was but the beginning of a great and important improvement. Although he had no practical acquaintance with the subject, yet economy of fuel in the generation of steam had occupied his attention through life; and although he scarcely thought that he should live to see it, yet he believed that electro-magnetic motion would ultimately be brought into practical use. The past history of steam gave every encouragement for hope.

Mr. ALLAN, in reply, said, when he undertook to read a paper on electro-magnetism as a motive power, he was aware that it was a venturesome task. He was aware of the amount of opposed theory that would be brought to bear against him; still he had laid his views before the meeting. He had told them at the outset that the matter was progressive—he might say, in its infancy—and he did not think, after having given a great amount of study and investigation to the subject, he had reason to be discouraged. He was not prepared to admit that the mechanical force of the electric current was no more than the heating power of the same current. His friend (Mr. Hearder) disagreed with him on the subject of the variation of the attraction as the squares of the distance. He did not say that was absolute, but it was dependent on the changes in what he would term the pole of the magnet. He had endeavoured to apply the forces in the most economical manner. The construction of the electro-magnet was a question in which there was a great deal still remaining to be done, and in the production of electricity it was impossible to predicate what might eventually be accomplished. He had merely taken the battery as he found it, and applied it to give power and motion to the machine. In the little engine before them the fault was that it did not produce within one-fifth the power it ought to do, owing simply to faulty construction, which could be got over in any machine hereafter to be made. The machine before the meeting had been tried at the Conservatoire des Arts et Metiers, Paris—not for the purpose of showing power at a small cost, but the principle of the application of the forces, for there were faults in the construction of the machine which changed the relative proportions to a great extent. It was the opinion, then, that the power would be best developed at a lower speed, and it was found upon calculation that the cost of working was 27 times that of steam. With regard to the battery power alluded to by Mr. Hawes, he had brought what was suitable for the purpose, but it did not follow that because the battery was of large dimensions, that therefore it was a battery of enormous consumption. He had found that the most economical way of working was to have a large reservoir of electricity, so to speak, so as to work a long time without the battery diminishing in power. The small model on the table had been kept at work for 10 days and nights without cessation, and without change of the

battery power. Notwithstanding all that had been said on this subject—and he did not object to opposition—it would only stir him up to further research, and he hoped on a future occasion to come before them with still better ascertained results.

The Chairman said they would all agree that Mr. Allan had brought before them a most interesting paper, and he felt sure the meeting would be ready to accord their thanks to him.

A vote of thanks was then passed to Mr. Allan.

The Secretary read the following letter from Mr. Henry Reveley, and described the diagrams illustrating arrangements referred to in that gentleman's letter:—

"Sir,—A description of a patented invention for this purpose is now being noticed in the public prints, and I beg to be allowed a small space to state the fact that this invention is identical with an experimental engine made under my direction by Mr. Palmer, philosophical instrument-maker, late of No. 122, Newgate-street (Horne and Thornthwaites'), about the year 1840.

"My invention consisted of a polygonal piston-rod, armed with any number of keepers passing up and down between an indefinite number of stages of powerful horse-shoe electro-magnets, combined with a new mode of instantaneously making and breaking any number of circuits by means of cranks and jointed levers.

"The peculiar advantage of this construction would be, its applicability to every kind of existing steam-engine, with the sole alteration of removing the boilers and cylinder.

"My invention, which comprised no loose parts, was condemned by Mr. Palmer, for this reason, viz., that only 6¼ per cent. of the holding power of an electro-magnet in contact with keeper could be made available as motive-power at the distance of the thickness of a sheet of letter-paper. That is to say, that an electro-magnet whose holding power in contact was 100 lbs., would only exert a pull of 16 lbs. at the above mentioned distance, and therefore was much too expensive a mode of creating motive-power.

"Mr. Palmer and his foreman, who made the experimental engine, can attest these facts."

The Secretary announced that on Wednesday next, the 31st instant, there would be NO MEETING of the Society, and that on Wednesday evening, the 7th of April, a Paper by Dr. Odling, on "The Chemistry of Bread-making," would be read.

SOUTH KENSINGTON MUSEUM.

During the week ending 20th March, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 4,340; on Monday and Tuesday, free evenings, 4,213. On the three Students' days (admission to the public 6d.), 1002; one Students' evening, Wednesday, 105. Total 9,660.

Home Correspondence.

PUDDLED STEEL.

Sir,—In my letter of the 17th of March, in reference to puddled steel, I omitted to mention that, in addition to that quality of which the tensile strength is stated at 160,000 lbs. per inch, and in one sample 173,817 lbs., other samples representing a different quality of the material, exhibited a strength of 112,000 lbs. per inch, or about *twice* the strength of iron.

To ascertain the relative weight of a girder of puddled steel of this quality, as compared with ordinary iron, and using the same letters as before, we have $\frac{2\,(w + ul)\,l}{d\,a} = \frac{(w' + ul')\,l'}{d'\,a'}$. The spans and depths being the same, $l = l' - d = d'$, and $a : w :: a' : w'$. Therefore $w' = \frac{w\,n\,l}{w + 2\,n\,l}$. Applying this to the case of the Menai tube; $w' = \frac{1553 \times 460}{1553 + 2 \times 460} = 289$ tons.

That is to say, a girder of 289 tons would possess the same effective strength as the Menai tube, which weighs 1,553, if the material employed were twice the strength of iron.

The result, like that mentioned in my former letter, is sufficient to show the great importance of obtaining a more accurate knowledge of the new material—and it is especially important to ascertain, by testing numerous samples, whether the strength of puddled steel can be depended upon as an uniform result, and if not, to what degree of variation it is subject.

I am, &c.,

W. H. BARLOW.

Proceedings of Institutions.

Liverpool.—On Tuesday evening, March 9th, a meeting was held of all the pupils of the evening schools, at the Collegiate Institution, the Rev. J. S. Howson, M.A., principal, in the chair. He introduced the Rev. Dr. Hume, Local Secretary of the Society of Arts, at Liverpool, who delivered an address, stating the nature and advantages of the Examination to be held in connection with the Society. A similar address had been delivered at the Liverpool Institute, at its annual meeting on the 20th of January, William Brown, Esq., M.P., in the chair. In both cases the thanks of the meeting were given to Dr. Hume for his full explanations. A Local Board has been formed to conduct the preliminary examination and superintend the subsequent one.

Redhill.—The fourth annual report of the Institution for the last year records the continued progress of the society, and states that while the returns show double the number of subscribers to have withdrawn, as compared with last year, a much greater number has been added to the honorary as well as the ordinary list of members; and it is hoped that the advantages offered by an interchange of privilege with Reigate Institution, combined with other means now in progress and contemplation for general improvement, will excite and maintain a still greater interest in promoting the objects of the Institution. The number of subscribers at the present time is 170; 90 have been admitted during the year; 60 have left; leaving a net increase of 30. The number at the close of last year was 140. Two musical entertainments and sixteen lectures have been given during the year, seven gratuitous, and eleven at an expense to the Institution of nearly £32. The library now contains 597 volumes, of which 127 by gift and purchase have been added during the year. The number of each class of books issued during the year was as follows:—Educational, 118; Biographical, 59; Poetical, 64; Historical, 44; Miscellaneous, 333; Novels, &c., 504; making the total number, 1,122. Those of a light class, 504; and those of an instructive character, 618. The elementary class for writing and arithmetic, has been much better attended, and the discussion class has been recommenced. The class for instrumental music has given a lively interest to the Institution, and one has also recently been formed for vocal practice and instruction. The financial position of the Institution is favourable, and the Committee desire specially to acknowledge a donation of £10 10s. 0d., from W. Klein, Esq.; also £5 5s. 0d. from W. Hackblock, Esq., M.P.; this latter sum having been given for the purchase of books.

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
United Service, 8½. Capt. Nelloth, R.N., "On the Atlantic Telegraph Cable."
TUES. Civil Engineers, 8. Mr. R. C. Despard, "Improvements of the River Lee Navigation; with remarks on Canals."
WED. Chemical, 8. Anniversary.
THURS. Linnæan, 8. Mr. C. Dresser, "On Contributions to Organographic Botany."
Chemical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette*, *March* 19, 1858.]

Dated 7th Feb., 1858.

24. J. Kidd, 6, Bridge-parade, Bristol—Improved apparatus for regulating the pressure and supply of steam, gas, or other rarified or compressed bodies, and for causing more perfect combustion of the gases procured from coal, and increasing the heating and illuminating power of the said gases.

Dated 9th Feb., 1858.

240. R. Millard, Duncannon-street, Trafalgar-square—A portable chair.

Dated 13th Feb., 1858.

275. J. Duncan, Greenock—Imp. in the manufacture of ornamental chenille fabrics.

Dated 20th Feb., 1858.

338. J. Sworn, 29, Churton-street, and Thomas Weston, 40, Churton-street, Pimlico—An improved adhesive composition for whitening and clearing the surface of stones.

Dated 1st March, 1858.

393. T. Mills, Partick, Lanark, N.B.—Imp. in apparatus for treating and dressing flour or reduced grain.

Dated 3rd March, 1858.

416. W. H. Sleeboom, Hamburgh—Imp. in the construction of the keel of ships or other vessels.
418. G. and J. Kirkley, Salford—Imp. in perforating slates or similar materials.
424. J. Fowler, jun., Cornhill—Imp. in apparatus employed in laying down electric telegraph cables.

Dated 4th March, 1858.

426. C. Hart, P. Gibbons, and H. Gibbons, Wantage, Berkshire—Imp. in the construction and arrangement of combined thrashing and winnowing machines, and in the application of animal power thereto.
427. J. M. Ure, Glasgow—Improved apparatus for lifting the driving wheels of a locomotive off the rails, and which can be used when the locomotive is either running or stationary.
428. G. F. Hipkins, Birmingham—Imp. in constructing and attaching knobs and spindles, and in connecting knobs to doors, drawers, and other articles.
429. J. Knowelden, Southwark—Imp. in obtaining motive power.
431. J. Dewar, Edinburgh—Imp. in the manufacture of boots and other coverings for the feet.
432. C. P. Stewart, and D. G. Hope, Manchester—Imp. in locomotive and other engines.
434. P. Moore, Birmingham—An imp. or imps. in the manufacture of hinges.
435. T. Cowper, Douglas, Isle of Man—Imp. in the construction of ships or vessels, and the method of discharging bilge water therefrom.
437. W. Thomson, Glasgow—Imp. in apparatus for applying and measuring resistance to the motion of rotating wheel shafts or other rotating bodies.

Dated 5th March, 1858.

438. C. Boyce, Tipton—A new or improved anchor.
439. H. G. Collins, Paternoster-row—An improved method of obtaining impressions on an enlarged or diminished scale from engraved plates or other printing surfaces.
440. A. G. Barham, Bridgewater—Imp. in the manufacture of gypsum.
441. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the manufacture of wrought iron wheels for locomotives, tenders, waggons, &c. (A com.)
442. N. Common, Rose-hill, Brighton—An improved arrangement of water supply valve.
443. J. F. Cole, Devonshire-street—An imp. in watches and other time-keepers, and an improved escapement wheel or pallet to be employed therein.
445. C. F. Parsons, Duke-street, Middlesex—Imp. in machinery for producing and revivifying animal charcoal.
446. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in railway signals. (A com.)

Dated 6th March, 1858.

447. C. R. Moate, 65, Old Broad-street—Imp. in the permanent way of railways.
449. S. Wheatcroft, 14, Brudenell-place, Hoxton—The manufacture of cap fronts, and applicable to the manufacture of ruches and ribbon trimmings.
451. J. S. Nibbs and J. Hincks, Birmingham—Imp. in oils and spirit lamps.
453. W. Wilkinson, Bayswater—Imp. in the means of facilitating communication across seas or other waters, parts of which are applicable to telegraphing on land.
455. E. Burke, 69, Upper Thames-street—An imp. in applying iron tubes to locomotive and other tubular steam boilers. (A com.)
457. W. Reid, 58, Westgate-street, Newcastle-on-Tyne—Imp. in the permanent way of railways.
459. A. S. M. Derouen, Paris—Imp. in machinery for combing fibrous substances.
461. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the production of aluminium and its alloys, and in the production of other metals, the oxides of which are not reducible by charcoal. (A com.)
463. E. Morel, Ghent, Belgium—Improved machinery for drawing fibrous substances. (A com.)

Dated 8th March, 1858.

465. G. Redford, 6, Hutton street, Moss Side, Manchester—Making bullet-cartridges of one continuous piece of metal.
467. T. Lyne, Malmsbury, Wilts—An improved harrow.
469. J. Young, Wolverhampton—An imp. or imps. in the manufacture of hinges.
471. J. P. Budd, Ystalyfera Iron Works, Swansea—Imps. in the smelting or refining of tin, tin ores, and tin scruff.

Dated 9th March, 1858.

473. M. Casentini, Westminster-road, Lambeth—Imps. in preparing and indurating plaster, in preparing surfaces to receive plaster, and in preparing or perfecting plaster surfaces.
475. R. Skene, Garmouth, Fochabers, Elgin, N.B.—Imps. in obtaining motive power from water.
477. G. F. Harrington, Ednam House, Ryde, Isle of Wight—Imps. in the manufacture of artificial teeth and in the beds and palates for teeth.
479. J. H. Johnson, 47, Lincoln's-inn-fields—Imps. in the manufacture of stockings and other hosiery goods. (A com.)

Dated 10th March, 1858.

481. G. Davies, 1, Serle-street, Lincoln's-inn—An improved eye or ring bolt. (A com.)
483. B. Beale, East Greenwich—An improved method of cutting and shaping spokes.
485. G. S. Andrews, Charlewood-street, Pimlico—Imps. in washing machines.

Dated 11th March, 1858.

487. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in life boats. (A com.)
489. J. Young, Glasgow—Imp. in lamps.
491. J. D. Humphreys, Charlotte street, Middlesex—Imp. in machinery for moulding, compressing, and solidifying artificial fuel and other substances capable of being compressed.
493. F. A. Verdeil, Rue St. Sulpice, Paris—Imp. in treating madder.

WEEKLY LIST OF PATENTS SEALED.

March 19th.

2448. E. B. West.
2456. R. Lawson.
2457. Hesketh Hughes.
2463. F. C. Bakewell.
2469. W. B. Johnson.
2471. A. V. A. Laugère.
2476. L. Newton.
2493. W. Bowler.
2546. C. Reeves.
2547. W. and G. Richardson.
2550. M. Henry.
2618. M. Martin.
2688. A. V. Newton.

March 23rd.

2474. J. Barber.
2475. J. Kelshaw and J. Wilkinson.
2484. J. Lewis.
2490. R. Kay.
2498. W. W. White and W. Bull.
2506. W. E. Newton.
2565. A. Applegath.
2571. T. Forsyth.
2595. F. A. Calvert.
2626. J. H. Johnson.
2627. E. Owen.
2673. E. Cockey, H. Cockey, and F. C. Cockey.
2753. G. W. Robinson.
2755. J. B. Fraser.
2769. R. M. E. Hall and J. Hall.
2931. J. H. Johnson.
3022. J. Sinclair.
3037. H. Dolman.
3165. A. Chaplin.
30. E. Maw.
72. J. Austin.
73. R. Archibald.
81. T. Hamilton.
91. T. Pirie.
102. J. J. Russell.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

March 16th.

618. W. Smith.
655. W. Brown.
680. G. L. Turney.

March 17th.

616. R. E. Hodges & C. Murray.
668. F. Crossley.
811. I. Vernon.

March 18th.

625. B. O. Stratford.
661. J. Britten.

March 19th.

630. A. V. Newton.
663. J. McKinnell.

March 20th.

647. J. Willis.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4067	March 17.	Catch or Fastening for Cupboard and other doors	T. Pemberton and Sons	Birmingham.
4068	,, 19.	Certain parts of Folding Bedsteads or Chairs	H. Thompson	302, Strand.

Journal of the Society of Arts.

FRIDAY, APRIL 2, 1858.

EXAMINATION, 1858.

The Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea, has been elected Chairman of the Society of Arts' Board of Examiners.

The Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy, Oxford, has been appointed one of the Society's Mathematical Examiners.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday, the 24th April, at the Society's House, for which a card will be issued to each member; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit a member and two friends, ladies or gentlemen.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition will be opened on Monday next, the 5th instant.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or written order bearing their signature, may admit any number of persons. A sheet of tickets for this purpose is issued to every member with this day's *Journal*.

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	£1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	£ 2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P.	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

EXAMINATIONS.

The following letter has been received from the Royal Cork Institution:—

"Your favour of the 13th reached me, but several circumstances prevented my replying to you promptly.

"Accept my thanks for your specially calling attention to the Programme of the Examinations of the Society of Arts. It has happened, however, that hitherto no such plans or arrangements have existed here—at least for many years—as would have been suited to the preparation of candidates, and therefore any attempt in that direction would require longer time than the interval between the first notice we received and the time fixed for examinations.

Your estimate of the facilities afforded by the Library, the Athenæum, and the School of Design, is a correct one, but we have scarcely yet fully emerged from pecuniary difficulties respecting some of them, which have required all our attention.

I am fully determined to take steps for the preparation of candidates and the formation of a Local Board for next year, and through the press to prepare the public mind here for it. Although, then, I prefer not moving in it at all this year to moving imperfectly, I trust that Cork will be worthily represented on a future occasion. I am, &c.,

NICHOLAS PETERSON,
Hon. Sec. and Treasurer.

SUPPLY OF COTTON.

The following letter, addressed to Mr Macgregor Laird, has been communicated to the *Journal* by Mr. Thomas Clegg:—

Manchester, March 18, 1858.

My dear Sir,— * * * * It is not necessary for me to reiterate what you must already have so often heard, but I may state that my operations in Africa were commenced some seven or eight years ago, with the view of putting down the slave trade by a new, but very simple method, viz., convincing the native African chiefs and others, that it was their interest to employ their people, instead of making war upon each other, for the sake of getting a colourable right or pretext for selling into slavery the prisoners taken in such marauding expeditions.

I commenced at Sierra Leone, and strongly recommended every one to begin to collect the cotton already growing, and cultivate more wherever it would grow.

The Church Missionary Society kindly recommended agents to conduct the business, and in every way aided my efforts with the very great influence they so deservedly possess.

The African Native Agency Committee, of London, kindly paid the agents their salaries, and the African Improvement Society, of Sierra Leone, put down a hydraulic packing press, made by Messrs. Bellhouse, of Manchester, to pack such cotton as these agents and others might be able to purchase. Not being able to collect more than about 235 lbs. of clean cotton during the first year, I found that Sierra Leone was not the right place at which to try the experiment, and at once decided to go direct to the interior cotton field, and to the residence of the chiefs about Abbeokuta.

In the mean time I discovered that all our European agents either died off, or had to return to this country, and another long process had to be gone through, by which several more years were almost lost. The Missionary Society kindly selected several young Africans, who came over to this country, at the expense of the Native Agency Committee, to be educated and instructed in the best method of cleaning the cotton without injury to the fibre. Two of these I had at my mill in the country for several years, where they also learnt to work as mechanics, carpenters, &c. A third I had in my office in town as clerk, book-keeper, &c. In the mean time another young African, who had been educated as a surgeon in England, took the matter up heartily, and conducted the various transactions until the two others from the mill returned to their own country. These three native African youths have since conducted the whole of my operations in a manner most creditable to themselves and to their country. The African Native Agency Committee, of London, liberally supplied several packing presses, a boat, weighing machines, cotton stores, and other heavy articles, whilst I supplied cotton gins, goods, and money to purchase the cotton with. Consul Campbell, of Lagos, seeing the great advantage likely to accrue to Africa from the energetic prosecution of the new trade, rendered every assistance, indeed he applied for, and has obtained leave from government, to come over to this country, and may be expected this spring to come down to Manchester, where I hope he will be my guest, with a view to further and promote these operations under the sanction of our government. Up to the 1st of this month, I had sent out 157 cotton gins costing from £3 17s 6d. to £10 10s. each. I have entered into correspondence with upwards of 76 natives, and other African traders, 21 or 22 of them being chiefs, many of whom have begun to consign their cotton, as well as other produce, to me; and I assure you it gives me the greatest pleasure to sell it for the highest price I can obtain, as well as to invest the money in any articles they may require, with the exception of spirits, or the implements of war. In conducting this affair, I have to venture, and have now outstanding about £4,693, every shilling of which I expect to receive back, indeed I have bills of lading and advices of great quantities of cotton and other produce being on its way to me now, both on consignment and in liquidation of what is owing to me. I have had one transaction with one of these traders, from which he received £3,500; and it is both satisfactory and pleasing to know that every trader, almost invariably, takes back hardware, earthenware, cotton goods, or other merchandise for the whole amount of cotton or other produce sent here. Owing to the extensive fires at Abbeokuta, I have not got quite so much cotton as I expected in 1857, but I have had cotton advices and bills of lading for shipments from Lagos up to the 28th of December as follows, viz:—

	Bales.		Bales
Per Candace	46	Per St. George	81
,, Gambia	10	,, Powerful	249
,, Invincible ...	34	,, Oscar..................	37
,, Token	36	,, Saltern Rock	245
,, Yarrow	41	,, Propeller	34
,, Gambia	116		
		In the whole ...	929

Add to these, 17 tons burnt in the first fire, and 3,000lbs. to 4,000lbs. in the second, equal to 321 bales. Produced, or rather collected for sending to me, of usual size, 1,250 bales of African cotton; this quantity has therefore been purchased, and there has still always been *plenty more offering* on like terms, viz., 0½d. per lb. in the seed. On this account the people of Abbeokuta cannot be made to believe that England can purchase all the cotton that they can produce, and yet Abbeokuta is but just on the border, at one corner, I may say, of the great cotton field of Western Africa, extending from Abbeokuta to the Niger and away into the interior.

Coupling my experience on this coast—the belief of the Abbeokutans, and the recent dispatch of Dr. Bakie from the Niger to our Government, where he states that the Rev. Mr. Clarke had seen at Ilæ, near Ilorin, in the Yoruba country, fifteen or sixteen packages of clean cotton offered for sale, weighing 75lbs. to 80lbs. each—and had been assured by the natives that on market-days (every fourth) from 1,000 to 2,000 such bags were offered for sale, and this for their own country manufacture only—I say, coupling these statements with my operations, what I know of Tunis and Natal, and what Dr. Livingstone tells us of the East, I can clearly see a prospect of the slave trade being entirely starved out; the tractable, docile, and intelligent African, rising in the scale of civilization and Christianity, in proportion as he is allowed to enjoy his own rights, stay in, till the land, and trade in his own native country, even if confined to the cultivation of cotton alone.

You know much better than I do what Africa so abundantly produces besides cotton, such as palm and other oils, arrowroot, ground nuts, ivory, Cayenne pepper, fruits, spices, gums, resins, dyes, dye woods, &c.

I should give a poor idea of the prospect of the cotton trade, by simply mentioning the commencement and recent operations connected with my own experiment, for, in all such cases, people first look on, and when they clearly see advantage, they also set to work; so it has been, and so I wish it to be, in Western Africa. One trader has ordered a good serviceable English canoe to convey the cotton, whilst he and another have ordered each a good new packing press, at considerable expense, and as there are now, at least, four presses ready for work, and the natives are able of themselves to turn out 10 bales daily from each press, they should turn out 40 daily, or upwards of 12,000 annually, with their present appliances. Three makers of cotton gins at Manchester, through my and various other instrumentality, have sent out to Africa the following, viz.:—

		lbs.		lbs. lbs.
C. 34	gins, capable of cleaning	100	daily, say for safety	80...2,720
D. 66	,, ,,	100	,,	80...5,280
J. 150	,, ,,	40	,,	40...6,000
250	gins, capable of continuously cleaning daily...........			14,000

lbs. of clean cotton, 4,368,000 lbs. yearly = 10,000 American or 40,000 African sized bales of cotton; and as all these gins have been bought, and, in most instances, paid for on delivery, I believe they will not be allowed to be idle. This, I think, is a rare instance of rapid development of a particular trade, and the more so inasmuch as, in my case, every ounce of cotton has been collected, all the labour performed, and the responsibility of doing it borne by native Africans alone. I have many reasons for believing that the whole matter will prosper; first, I believe it has God's blessing upon it; next, Africa is naturally adapted for growing cotton, as everywhere it springs spontaneously, and is indigenous to the country; next, because, wherever cotton will grow, the people cry out for the African to come and help them to cultivate it, showing, in my opinion, that he is its natural cultivator also. Besides all this, I find that African cotton, whether from Quilimane on the east, Abbeokuta on the west, Tunis or Algeria on the north,

or Natal in the south, that this cotton is the best substitute for American cotton. Indeed, from whatever part of Africa it comes, in its natural state, it will invariably fetch in the Liverpool market from 2d. to 3d. per lb. more than East India cotton under similar circumstances. For some years this cotton has never cost more than ½d. per lb. in the seed, and at that price the agents, chiefs, and dealers, have never been able to buy up what has been offered, and this, I think, is a proof that it can be produced exceedingly cheaply, sufficiently so to compete with any other country.

It can be laid down in Liverpool, in all ordinary times, at about 4¼d. per lb., viz., cost of it in the seed ½d.

4 lbs. to make one	2d.
Cleaning 30 to 40 lbs. for 4d., say	¼
Packing and canvas	½
Carriage and charges on board	¼
Freight to England (too much by half)	1
Charges in England	¼
	4¼

Recently, however, the Native Agency Committee have begun to charge those who use their gins and pack in their store 1d. per lb., and those who do this will be at a little more expense; but as the cotton is still worth 7d. in Liverpool, and not long ago was worth 9d., there is yet profit sufficient to encourage all natives to embark in the trade.

I believe first in the goodness of the cause, and next that to act entirely through the natives is the way, not only further to develop, but most certainly the most sure way of making it progressive and lasting. I have also a dread that if Europeans took up the cultivation of cotton, or dealing in the interior, it would in all probability result in the revival of slave labour, or merely in a spasmodic effort or two, and then a sickening off, a failure, and relinquishing the effort, after destroying in all probability the self reliance the native had formerly had.

On these grounds, then, I am anxious to raise at least £2,040 for four new cotton stations, and I hand you an estimate for them, which has been prepared by one who knows Africa and what is requisite much better than I do; it is as follows, viz:—

20 Gins £5	£100
Press	90
Weighing machine	20
Shed or native house	100
Wages for two natives one year	100
Capital to trade with	100
Or for each station	£510

I feel that I have not half done justice to this matter, and only regret that I have not been well enough, either to do it better now, or attend to it earlier. I must therefore supplement the statement by sending a few of my letters to the public papers, leaving you to deal with the whole in any manner most likely to redound to the benefit of Africa and this particular movement.

Yours, &c.,

THOMAS CLEGG.

McGergor Laird, Esq.

SOUTH KENSINGTON MUSEUM.

During the week ending 27th March, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 4,048; on Monday and Tuesday, free evenings, 4,649. On the three Students' days (admission to the public 6d.), 1078; one Students' evening, Wednesday, 523. Total 10,298.

Home Correspondence.

ELECTRO-MOTIVE MACHINES.

Sir,—I was compelled to leave the interesting discussion on the 24th ult. before it terminated. I beg now, therefore, to make a few remarks with regard to the subject of our paper.

The cost of electro-motive machines has hitherto been compared with steam only; and those who have given their attention to the subject have done so only with the view of supplanting steam in railway travelling and navigation; but there are other purposes for which they might be used, viz., for working small machines, where steam could not conveniently be employed. Type-casting machines, sewing machines, churns, and, perhaps, ere long, bread may be made by machines, under the patent of Dr. Dauglish.

These machines are easily managed, take up less room, and are not so dangerous as steam-engines.

If they could be applied to type-machines alone, for every four worked thus there would be a saving of £7 10s. per week; from this would have to be deducted the cost of material, which would not be great, as but small power is required.

In conclusion, I would remark that Dr. Farraday not long ago, lamented how little was known of electricity; and why should these machines be condemned before more is known about them? I am, &c.,

J. F.

IRON STRUCTURES.

Sir,—The allusions made to the tubular bridge across the Menai Straits in Mr. Barlow's letter which appeared in the last number of the *Journal*, brings to my recollection a thought that occurred to me some time ago upon reading the result of the experiments which were tried for testing the power of that and other bridges to bear the passing over them of heavy trains.

The gentlemen acting under her Majesty's Commission of August 27, 1848, "to inquire into the conditions to be observed by engineers in the application of iron to structures exposed to violent concussions, vibrations, &c., constructed an apparatus by means of which a loaded car was allowed to run down an inclined plane, and along iron bars which were placed horizontally at the bottom." The car acquired a certain amount of velocity in descending the incline to the bars which were the subjects of the experiments. First of all a load of 1,120 lbs. was placed at rest upon a pair of iron bars, 9 feet long, 4 inches broad, 1½ inches deep, occasioning a deflection to the extent of six-tenths of an inch; it was then passed over the bars at the rate of ten miles an hour, whereby the deflection was increased to eight-tenths of an inch; and finally, at 30 miles per hour, when the deflection was as much as 1½ inches. Since the velocity so greatly increases the effect of a given load in deflecting the bars, it follows that a much less load will break the bar when it passes over it than when it is placed at rest upon it; and accordingly, in the example above selected, a weight of 4,150 lbs. is required to break the bars if applied at rest upon these centres; but a weight of 1,778 is sufficient to produce fracture if passed over them at the rate of 30 miles an hour. It also appeared that when the motion was given to the load, the points of greatest deflection, and still more of the greatest strains, did not remain in the centre of the bars, but were removed nearer to the remote extremity of the bar. The bars, when broken by a travelling load, were always fractured at points beyond their centres, and often broken into four or five pieces, thus indicating the great and unusual strains they had been subjected to.

Experiments were made upon Ewell Bridge, on the Croydon and Epsom line, and on Godstone Bridge, on the South Eastern line, and the result arrived at was that the same load in motion, at the speed of 50 miles an hour, produced one-seventh more deflection than when it was at rest.

Similar experiments were made with the Britannia tubular bridge by the Government Inspector, Oct. 19, 1850. A train of 28 waggons and two locomotives, with 280 tons of coal, was drawn into all the four tubes, and the deflection was ascertained to be three-quarters of an inch. The same train with the same load was then removed to the distance of a mile, and was shot through the tube at the highest attainable speed, but the deflection was sensibly less than in the former case.

It will be observed that there is a difference between tubular and open bridges, the former being affected much less than the latter by a moving body. What has struck me is that the deflection depends, in a great measure, upon whether the air is in motion or at rest. All moving bodies are constantly displacing air equal to their own bulk. They are making vacuums at every change of position.

We know that, if a vacuum be caused by the explosion of gunpowder near a closed window, the air will press so heavily upon the opposite side that the glass will get broken. Why should there not be similar effects produced upon a railway bridge whilst a train is passing over it? There may be pressure on the under surface of the arch or on the upper. What would be the effect upon an arch if a body were placed upon it having the pressure of a ton to the square foot, and, if it were removed, leaving a vacuum, that is, nothing to oppose the pressure of the air from beneath?

The pressure of the air upon all sides of a tube externally is always equal, because a train would only put the air contained in the tube in motion.

I am, &c.,
G. R. RITCHIE.

24, Stockwell Park Road, Stockwell,
March 24, 1858.

Proceedings of Institutions.

Bury.—The fifth annual report of the Directors of the Athenæum, read at the annual meeting, Tuesday, January 19th, states that the number of members as compared with last year has to some extent diminished; yet, notwithstanding this, and taking into account the depression in trade, the paralysing influence of the commercial crisis through which the town and country generally are passing, the Directors have good reasons for stating that the financial position is better than it ever was since the opening of the Athenæum. The first business which occupied the attention of the Directors was the appointment of a Sub-Committee, to prepare a comparative statement of income and expenditure, taking as a basis the average of the last three years, in order to guide them in the conduct of the Institution, and to ascertain the probable condition of the finances at the expiration of their term of office. The estimated receipts from all sources were set down at the sum of £370, and the expenses at £446, showing a deficit of £76, on the year; and looking at this estimate and also considering the heavy liability of the Institution when they entered into office, the Directors were anxious to adopt some plan whereby this state of affairs might be amended. They decided to make an appeal to the employers of labour in the town and neighbourhood, soliciting them to become annual subscribers to the Institution of £1 and upwards, with the understanding that to the extent so subscribed they would be at liberty to nominate members to the Athenæum. This, however, has not yet been done. The Institution had to commence the year with a balance due to the bank of £688 6s. 1d., towards which sum there had been promised £339 1s. 0d., the whole of which has since been collected, and other donations have been received which have cleared off the building debt altogether, and also to a considerable extent reduced the current debt. The number of members in each quarter has been, on the average, 590. The circulation of books from the library has been as follows:—History, Antiquities, and Biography, 2,146; Geography, Voyages, and Travels, 780; Mathematics, Natural Philosophy, 826; Fine Arts, Useful Arts, &c., 392; Mental and Moral Philosophy, &c., 411; Poetry and the Drama, 296; Novels, Tales, &c., 5,612. Total 10,463. The classes have generally been well attended throughout the year; and many of the students have contributed much to raise the Institution in public estimation, in consequence of their successful competition in examinations. The writing, arithmetic, grammar, and composition classes have been very satisfactorily attended during the past year; and the teacher speaks well of the general attention and industry of the members. In order to satisfy a wish often suggested, the Directors established during the last quarter of the preceding year, a class for men above 21 years of age, for reading, writing, and arithmetic; this has been done mainly with a view to obviate the delicacy felt by adult members mixing with juniors, who having had greater advantages, were superior in attainment to those who might not have had the same educational opportunities in their youth. This class, so far, is as well attended as it is reasonable to expect in so short a time. The singing, drawing, and French classes have also been successful. An examination of the pupils in the classes has been held, and prizes were awarded to the successful competitors by the president, at his own expense. He has also presented to the Institution a very useful collection of models and plaster casts, for the use of the drawing classes. There is another subject in connection with the classes, to which the Directors wish to call special attention; and that is, the recent examinations which have taken place in Manchester, in conjunction, first with the Lancashire and Cheshire Institutional Association, and secondly, at the Royal Institution, under her Majesty's Inspector from the Board of Practical Art. With reference to the first, which was a competitive examination in the general branches of Instruction, ten pupils from the Institution received certificates and prizes for their several attainments. These were distributed by Lord Brougham, at a meeting held for the purpose in the new Mechanics' Institution, Manchester. The second examination at the Royal Institution, Manchester, was in drawing only. There were 18 members from the Athenæum, 12 of whom had prizes awarded; 14 prizes were presented in all, two members having obtained two prizes each. A course of four lectures on Electricity, Magnetism, Galvanism, and Pneumatics, was delivered by Mr. William Richardson. In concluding the report, the Directors desire to acknowledge the valuable assistance of those inhabitants of the town and neighbourhood who during the year 1857 have responded to the appeal of the Board, by contributing so liberally in aid of the liquidation of the debt.

Darlington.—The Committee of the Mechanics' Institution, for the year 1857, presented their report to the annual general meeting held on the 5th ult. The Penny Savings Bank has been continued with marked success. During the first year of its operations 1,143 accounts have been opened, and 334 again closed, leaving the present number on the books of the bank 809. The balance in the hands of the trustees amounts to £490 3s. 6d. The Committee believe that, by its instrumentality, a habit of carefulness and forethought is being created and encouraged amongst that class of persons intended to be benefited by the establishment of such an institution. The Committee regret that the

class department, so encouragingly referred to in the last report, has not, during the present year, displayed the same amount of healthy vigour. The writing class was but a short time in existence; and the class for arithmetic and mathematics could not be brought into operation for want of the requisite number of pupils. A similar attempt to establish a reading class likewise failed from the same cause. There is a German class and drawing class, but the students are not numerous. The Committee, in thanking those gentlemen who have kindly offered and given their assistance in this—one of the most important departments of the institution's operations—cannot but regret that their services have been so little appreciated and made use of by the members of the Institute. The Society of Art's Examinations, mentioned in the last report, were held at Huddersfield in June last. Only one member of this Institute (Mr. James Bower) attended, but the Committee have the satisfaction to state that he carried off a valuable prize in books, and obtained certificates in arithmetic, mensuration, geography, geometry, and algebra. The success which attended the Saturday Evening's Entertainments during the winter of 1856-7, and the practical good which it was hoped might arise from such an agreeable blending of instruction with amusement, induced the Committee to make a further effort in that direction. They regret to state that, although every exertion was made to render them attractive (keeping in view the object for which they were commenced) the proceeds did not on any occasion meet the expenses incurred. They were therefore discontinued. An excursion-trip to Ripon. Studley, and Harrogate afforded a day's most delightful enjoyment and recreation to those who joined in it, and realised to the Institution the sum of £1 16s. 3d. A *soirée* was held in December last. The whole of the provisions were provided gratuitously by the ladies, and the meeting was altogether a successful one. From this source the sum of £13 was added to the funds of the institute. The following lectures, during the session, have been delivered:—on "Paganism," by the Rev. Charles Cator, of Stokesley; on "Respiration," by J. R. Gibbes, Esq., of Northallerton; on "Shakespere," by the Rev. Marmaduke Miller, of Manchester;" on "The Oddities of London Streets," by Henry Mayhew, Esq., of London; on "Martin Luther," by George Dawson, Esq.; on "Beau Brummell," by George Dawson, Esq.; on "Pre-Raphaelitism in Poetry and Painting," by Mr. Gerald Massey; on "India," by Professor Partington; "on "The Generation and Application of Steam," by Mr. John W. Hackworth; on "Burns and Love-Poetry," by Mr. Gerald Massey; on "Rare Old Chester," by Mr. J. B. Marsh. Seventy-five new books have been added to the library during the past year, by presentation and purchase. The total number of books belonging to the Institute is 2,504. The issue has been 10,276 against 11,890 in the preceding year, showing a decrease of 1,614. The Daily News Room continues to occupy a prominent place in the operations of the Institute, and is well supported. The attendance of members at the Reading-room has been equal to, if not greater than, that of any previous year. The present number of members is 495, of whom 3 are life members, 72 news-room, 100 yearly, and the remainder half-yearly and quarterly, showing a decrease of 8 on that of last year. The number entered on the books during the year has been 642. There is still the debt of upwards of £300 upon the building. The interest payable upon this sum necessarily cripples the operations of the Institute, especially in the purchase of new books.

Portland Breakwater Mechanics' Institution.—The second annual meeting of the members of this Institution took place on Friday last, the chair being occupied by the President, John Coode, Esq. The Secretary read the report. It appears that at the commencement of the present year the number of members on the books amounted to 108, the additions during the year have been 40, and the withdrawals 27, leaving 121 members now on the rolls. The treasurer's statement of receipts and dibursements shows that, after defraying an expenditure of £109 1s. 3d. for books, concerts, lectures, rent, and salaries, there still remains a balance in hand of £5 3s. 11d., a result which is highly satisfactory considering the recent period of the formation of the Institution, and the necessarily heavy expenditure incurred in the purchase of a good library. During the year one hundred and ten volumes have been added to the library, and eleven lectures and two concerts have been given. The nightly attendance at the reading room has also been considerably in excess of last year. The great feature, however, in the report, is a proposal, on the part of the Committee, to reduce the entrance-fee and subscription to half the amount of the present charges. The entrance-fee of 2s. 6d. is to be reduced to 1s., and the annual subscription from 10s. to 5s. Although this will, in the first instance, diminish the Society's income, to a considerable amount, it is hoped that, ultimately, by the accession of new members, the present amount of receipts will not only be maintained but increased. Votes of thanks were passed to the Donors to the Institution, to Mr. J. G. Brown, the hon. Secretary, to Captain Joseph Cosens, and to the President.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Entomological, 8.
Tues.......Pathological, 8.
Photographic, 8.
Wed. ......Society of Arts, 8. Dr. Odling, "On Some Points in the Chemistry of Bread making."
Pharmaceutical, 8.
Royal Soc. Lit., 8½.
Thurs. ...Philological, 8.
Fri. ....United Service Inst., 3. Mr. J. Boucher, "The Comparative Merits of the Rifled Small Arms of England, France, and the United States, with remarks on the various modes of Grooving Rifle-barrels."
Archœological Inst., 4.
Astronomical, 8.
Sat...........Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 17th March, 1858.

13. Metropolitan Drainage—Copies of Letters.
25. Metropolitan Drainage—Papers.
115. Ameer Ali Moorad's Claim (Coffey's Petition)—Report from Committee.
118. Local Acts (1. Mersey Docks and Harbour (New Works): 2. Blyth Harbour and Dock; 3. London and South-Western Railway; 4. Exeter and Exmouth Railway; 5. St Helen's Canal and Railway (Extension from Garston to Liverpool); 6. Shoreham, Horsham, and Dorking Railway (Shoreham and Horsham Line); 7. London, Brighton, and South Coast Railway; 8. South Wales Railway (New Railway, &c.); 9. South Wales Railway (Further Powers); 10. Liskeard and Looe Union Canal Company and Railway; 11. Wexford Harbour Embankment; 12. Plymouth Great Western Docks; 13. East Suffolk Railway (Capital and Branch Railway); 14. Chiswick Improvement; 15. Yar Bridge; 16. Formartine and Buchan Railway; 17. Aberdeen, Peterhead, and Fraserburgh Railway; 18. Caledonian Railway (Dalmornock Branch); 19. Burghead Harbour (Extension and Improvement); 20. Corris, Machynlleth, and River Dovey Railway)—Admiralty Reports.
27. Bills—Commons Inclosure.
28. ——— Cambridge University Matriculation and Degrees.
29. ——— General Board of Health (Skipton, &c.)
30. ——— Militia Act Continuance.

Delivered on 18th March, 1858.

112. Kensington Gore Estate—Return (A corrected Copy).
113. Cape of Good Hope (Union Steam Navigation Company)—Return.
113. Harbour, &c., Bills (16. Sunderland Dock)—Board of Trade Report.
117. Railway and Canal Bills (15. Aberdeen, Peterhead, and Fraserburgh Railway; 16. Border Counties Railway Extension; 17. Brentford and Richmond Railway; 18. Chester and Holyhead Railway; 19. Cornwall Railway; 20. Cromford and High Peak Railway; 21. Darenth Valley Railway; 22. East Kent Railway (Dover Extension); 23. East Kent Railway (Western

Extension); 24. East Suffolk, Yarmouth and Haddiscoe, and Lowestoft and Beccles Company Amalgamation; 25. Edinburgh and Glasgow, and Stirling and Dunfermline Railways: 26. Inverary and Old Meldrum Junction Railway; 27. Knighton Railway)—Board of Trade Reports.

Delivered on 19th March, 1858.

117. Railway and Canal Bills (28 London, Brighton, and South Coast Railway (Capital, &c.); 29. London, Brighton, and South Coast Railway (Shoreham to Henfield, &c.); 30. Manchester, Sheffield, and Lincolnshire Railway (Newton to Comstall); 31. Metropolitan Railway (Abandonment of Undertaking, &c); 32. Mid Kent Railway (Croydon Extension); 33. North British Railway (Consolidation, &c.); 34. Severn Valley Railway (Extension of Time); 35. South-Eastern Railway (Dartford, New Cross, &c.); 36. Ware, Hadham, and Buntingford Railway; 37. Waveney Valley Railway; 38. Andover Canal; 39. Ayr and Dalmellington Railway; 40. Bognor Railway; 41. Caledonian Railway (Branch to Port Carlisle Railway); 42. Carlisle, Langholm, and Hawick Railway; 43. Corris, Machynlleth, and River Dovey Railway; 44. Devon Valley Railway; 45. Durham and Cleveland Union Railway; 46. Eastern Counties Railway; 47. East Suffolk Railway; 48. Exeter and Exmouth Railway; 49. Fife and Kinross and Kinross-shire Railways; 50. Formantine and Buchan Railway; 51. London and South-Western Railway; 52. North British Railway (Hawick and Carlisle Junction); 53. Redditch Railway; 54. Shoreham, Horsham, and Dorking Railway; 55. Stokes Bay Railway and Pier; 56. Ulverstone and Lancaster Railway; 57. Victoria Station and Pimlico Railway)—Board of Trade Reports.

Ecclesiastical Commissioners for England—10th General Report.

Church Estates—7th General Report from Commissioners.

Delivered on 20th and 22nd March, 1858.

135. Greenwich Hospital—Copy of a Memorial.
138. Committee of Selection—4th Report.
126. Militia—Return.
129. East India (Castes of Hindoos)—Return.
134. Superintendents of Naval Yards—Return.
117. Railway and Canal Bills (58. Luton, Dunstable, and Welwyn Junction, and Hertford and Welwyn Junction Railway Companies Amalgamation; 59. Mid-Kent Railway (Bromley to St. Mary Cray); 60. Shrewsbury and Welchpool Railway; 61. South-Eastern Railway and Mid-Kent Railway (Bromley to St. Mary Cray); 62. Staines, Wokingham, and Woking Railway; 63. Stockport, Disley, and Whaley Bridge Railway; 64. Stockton and Darlington, Wear Valley, &c., Railway Companies Amalgamation; 65. Stockton and Darlington Railway (Durham Lines); 66. Stockton and Darlington Railway (North Riding Lines); 67. West End of London and Clapham and Norwood Junction Railway Abandonment; 68. West End of London and Crystal Palace Railway; 69. Whitehaven Junction Railway)—Board of Trade Reports.
31. Bills—Medical Profession.
32. ——— Galway Freemen Disfranchisement.

Civil Service—3rd Report of Commissioners.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 26, 1858.]

Dated 11th Feb., 1858.

259. C. Johnson, Dickleborough, Norfolk, and G. Johnson, Wandsworth—Improved machinery or apparatus for performing different operations required in agriculture.

Dated 25th Feb., 1858.

378. S. Middleton, 5, Little New-street, Fetter-lane—Imp. in the uniting or seaming articles of leather, and in the apparatus connected therewith.

Dated 27th Feb., 1858.

390. D. Nurse, R. Nurse, and G. Nurse, Machan, South Wales—Imp. in coating metals, and in the apparatus connected therewith.

Dated 4th March, 1858.

433. S. Boulton, 11, Luther-street, Everton, near Liverpool—Obtaining by an improved method certain products from materials used in the manufacture or purification of gas.

Dated 5th March, 1858.

444. J. N. Hearder, Plymouth—Imp. in submarine telegraph cables.

Dated 6th March, 1858.

448. G. Davies, 1, Serle street, Lincoln's inn—A substitute for red lead, either as a cement for joints or a coating for preserving metals. (A com.)
450. R. S. Bartleet, Redditch, Worcester—An imp. or imps. in papers, envelopes, or cases for holding needles.
452. Comte C. Cavalli de St. Germain, Piedmont—imp. in the manufacture of starch.
454. R. A. Brooman, 166, Fleet-street—An imp. in the construction of skirts and petticoats. (A com.)
456. A. Whytock, 12, Little St. Andrew-street, Upper St. Martin's lane—Imp. in apparatus to be applied to wheels to facilitate them in travelling on common roads and other surfaces.
458. J. W. Clare, Surrey-square—Imp. in apparatus for stopping or retarding railway engines, carriages, and trains, and communicating signals between parts of a train.
462. C. Sanderson, Sheffield—Imp. in the manufacture of malleable iron and steel.
464. J. H. M. Maissiat, Paris—Imp. in dibbling machinery for depositing grain and manure.

Dated 8th March, 1858.

468. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the decoration or ornamentation of leather, cloth, and similar fabrics, and the application of the same to various useful purposes. (A com.)
470. H. Doulton, Lambeth—Imp. in the manufacture of smoke and air flues.
472. W. Clark, 53, Chancery-lane—Imp. in gas meters. (A com.)

Dated 9th March, 1858.

474. J. E Poynter, Glasgow—An improved illuminating oil.
480. G. T. Peppé, 68, Britannia-terrace, City-road, and Louis Goodman, 285, Oxford street—Imp. in the construction and arrangement of timekeepers.

Dated 10th March, 1858.

482. H. Dauphin, Nantes—A new or improved machine for giving to metallic bands a circular or partly circular form.
484. W. Harding, 1, Park-villas, Forest-hill—Imp. in breech-loading firearms.

Dated 12th March, 1858.

497. J. Worrall, Salford, and C. Race, Manchester—Imp. in machinery or apparatus for stretching and drying fabrics, part or parts of which said apparatus are also applicable to other machines wherein fabrics are required to be distended.
499. J. Warburton, Low mills, Addingham, near Otley—Imp. in carding engines. (Partly a com.)
501. T. T. Chellingworth, Birmingham—Imp. in suspending chandeliers and gas pendants.
503. A. Ash, Woolwich—An improved pocket or other like safety clasp or protector.
505. J. Wright, 10, Alfred place, Newington-causeway, Southwark Imp. in the mode of treating tanned and untanned hides and leather. (A com.)
507. L. F. Corbelli, Florence—An improved process for extracting aluminium from its compounds, and obtaining at the same time protochloride of mercury. (Partly a com.)

Dated 13th March, 1858.

509. G. Carter, Mottingham, Kent—Imp. in steam engines and machinery for propelling vessels and other bodies in water, and other purposes.
511. S. T. Parmelee, Edinburgh—A new mode of combining certain materials to be used in the manufacture of boots and shoes.
513. S. Walker, Birmingham—Imp. in the manufacture of tubes of copper and alloys of copper.
515. W. Riddle, 4, Stonefield-terrace, Liverpool-road—Imp. in the manufacture of wrought iron nails.
517. S. T. Osmond, Ramsbury, Wiltshire, and E. D. Collins, Newbury—Imp. in ploughs.

Dated 15th March, 1858.

519. J. D. Briet, Paris—Imp. in pipes for smoking.
521. J. Gough, Chester—Imp. in horse-gear for driving machinery.
523. L. J. Tellier, Pithiviers—Improved machinery for raising water and other liquids.
525. A. Ferry—Imp. in cornets and other wind musical instruments. (A com.)
527. J. S. Russell, Great George-street, Westminster—Imp. in preserving the bottoms of iron ships and vessels.
529. A. Wallis and C. Haslam, Basingstoke—Imp. in engine, machine, and other like bearings.
531. E. A. L. D'Argy, Batignolles, near Paris—A new or improved rotary hydraulic blowing engine.

Dated 16th March, 1858.

533. G. Hall, St. John's, Worcester—Certain imp. in cartridges and gun wads.
535. W. T. Eley, Broad-street, Golden-square—Imp. in cartridges.
537. P. Le Capelain, Blackfriars-road—Imp. in dry gas meters.

WEEKLY LIST OF PATENTS SEALED.

March 25th.

2254. A. V. Newton.

March 26th.

2499. W. Bayliss.
2514. C. C. Creeke.
2517. W. Henderson.
2521. E. Leigh.
2522. J. G. Jennings.
2524. S. D. Hamilton.
2570. A. Boyd.
2580. W. R. Todd, jun.
2586. S. Walmsley.
2846. J. R. Cochrane.
3101. E. Highton.
47. E. H. Bentall.
112. H. Smith.
142. L. F. Corbelli.

March 30th.

2419. D. Imhof.
2516. W. Sandilands
2518. J. Harris.
2520. J. and J. Long.
2538. J. A. Molineaux and J. Nichols
2562. J. Stoneham and J. P. Lees.
2568. R. Romaine.
2636. C. Reeves.
2678. M. A. F. Mennons.
2694. M. A. F. Mennons.
2138. W. E. Newton.
2. J. Murphy.
16. J. Leeming and J. C. Ramsden.
138. Sir Henry Stracey.
208. D. Williams.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

March 22nd.

645. F. Ransome.
671. J. Marland.
709. W. Tytherleigh.

March 24th.

664. J. H. Johnson.
711. M. Prentice and T. Richardson.
712. J. Morgan.
786. P. A. le Comte de Fontainemoreau.

March 27th.

700. J. Blair.
741. P. R. Jackson.

Journal of the Society of Arts.

FRIDAY, APRIL 9, 1858.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday, the 24th April, at the Society's House, the card for which will admit the member only; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit the member and two friends, ladies or gentlemen. The cards for each of these evenings have been issued this day. Members not receiving them are requested to communicate with the Secretary of the Society of Arts.

Members of Institutions in Union who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday last, the 5th instant.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members, by ticket, or written order bearing their signature, may admit any number of persons.

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date :—

T. D. Acland, Member of Council	£ 5	5
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	£ 2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	£1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P.	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

LOCAL BOARDS—PREVIOUS EXAMINATION.

Forty-seven Local Boards have been formed. Returns of the Candidates who have passed the Previous Examination have been received up to the 7th inst., as follows :—

Leeds	4
Wigan	6
West Hartlepool	3
Leeds Christian Institute, No. 1	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	83
Newcastle-on-Tyne	3
Lymington	1

THE MULREADY DRAWINGS.

Previous to the presentation of these drawings to the National Gallery,* photographic copies of them were taken by Mr. Thurston Thompson, at the request of the Council. Mr. Thompson has arranged to supply copies to members of the Society, the price being seven shillings and sixpence for the set of three. Members desiring to have copies should communicate with Mr. Thurston Thompson, at the department of Science and Art, South Kensington, S.W.

SEVENTEENTH ORDINARY MEETING.

Wednesday, April 7, 1858.

The Seventeenth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 7th inst., Dr. Frankland, F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Blakeley, Capt. Alex. Theophilus, R.A.	Smith, Thos. Roger.
Hobbs, William Fisher.	Symonds, Frederick.
Seymour, Hon. F.	Vyvyan, Richard Henry Stackhouse.

The following Institution has been taken into Union since the last announcement :—

Dorking Literary and Scientific Institution.

* See the present volume of the *Journal*, p. 237.

Previous to the reading of the Paper, the Secretary announced that since the last meeting the Society had to regret the loss of two of its most valued members, Mr. Richard Horsman Solly and Mr. Herbert Minton. Mr. Solly, it is well known, took the warmest interest in the welfare of the Society for more than half a century, and was formerly among those most active in its management and most liberal in its support. At a time now nearly twenty years since, when many members had deserted it, and when it was even proposed that this Society, to which the Arts, Manufactures, and Commerce of the country owed so much, should be dissolved from want of funds, he generously came forward and assisted it. The fine picture of Adam and Eve, by James Barry, belonging to the Society, was a gift from Mr. Solly. As a patron of Art, and as a philanthropist, the name of Richard Horsman Solly stands prominently forward, and the Council feel that the loss of so old and valued a friend of the Society should not be passed over unnoticed. Mr. Solly was elected a member of the Society on the 1st of February, 1804, and died on the 31st of March last.

With reference to Mr. Herbert Minton, it should not be forgotten that when the Society first directed the attention of manufacturers to the importance of improving articles of general utility, by giving them more artistic forms with more perfect execution, that gentleman was among the first to carry into effect the improvements thus suggested. He also materially assisted the Society in its efforts to establish Industrial Exhibitions in this country; and the fine specimen of tesselated pavement in the Society's Hall, presented by him in 1846, will long remain a testimony to the skill and enterprise he displayed in developing this new industry. Mr. Herbert Minton was elected a member on the 3rd of June, 1846, and had served the office of Vice-President. He died on the 1st of the present month.*

The Paper read was :—

ON SOME POINTS IN THE CHEMISTRY OF BREAD-MAKING.

By William Odling, M.B., F.C.S.

I think myself justified in bringing under your notice a subject apparently so worn out as that of bread-making, from the circumstance that one particular phase of the process is only just now beginning to receive its due share of recognition. About twelve months ago, I published a short paper in the *Lancet*, wherein I adverted to the changes which the starch of wheat flour undergoes during the process of bread-making; and I propose this evening, while glancing generally at the phenomena of panification, to direct your attention principally to these hitherto much-neglected changes of the starch, and to the means of preventing them. You know that by the processes of grinding and dressing, wheat grain is separated by the miller into several products, which are known by the names of "firsts," "seconds," "tails," "middlings," "sharps," "pollard," "bran," &c., and that the tails and middlings are frequently re-dressed, or re-ground and re-dressed, so as to afford a larger yield of flour. This flour is composed of several distinct alimentary principles, which may be roughly separated from one another by the action of water. If a mass of moistened flour be kneaded into a stiff paste, and be then well washed with water, there are produced a milky liquid, and a viscid tenacious elastic solid, which is called gluten. This gluten ought to be thoroughly washed with water, until the washings cease to be in any degree milky. When the turbid milky liquor, produced by washing and kneading the stiff paste and gluten with water, is set aside for some time, there are gradually formed an opaque white deposit and a clear supernatant fluid, which may be separated from one another by filtration. The opaque white deposit which is retained on the filter consists of starch; while the clear liquid holds in solution several substances which together constitute the extractive. These three principal components of wheat-flour, namely, the gluten, the starch, and the extractive, are capable of being separated from one another as above described with sufficient precision to allow of their estimation, and consequently we analyse flour by ascertaining the per centage amount of each of these substances. But flour being a very hygrometric body, is usually somewhat damp; and hence in comparing different samples, we are also required to ascertain the amount of water which each contains. This is done by drying the samples in a water-bath, or *in vacuo* over oil of vitrol. In addition to the above four substances we sometimes estimate two others, viz., the bran and the ash. From specimens of flour that have been badly dressed, a considerable quantity of fine bran may be obtained by careful sifting, and may then be weighed. We find that flour when burnt disappears in very great measure, but leaves a small quantity, usually less than one per cent., of a white or greyish ash, the weight of which can also be ascertained. Now the gluten, the starch, and the extractive, all exert important agencies in the process of panification, and demand a few moments' further consideration. The gluten of which we have spoken, usually called Beccaria's gluten, is a nitrogenised substance, closely allied in its chemical constitution and properties to flesh. It is essentially the flesh-forming constituent of wheat flour. It is not a pure form of vegetable fibrine, but usually contains a certain proportion of fine bran mechanically intermixed with it, a small quantity of fat which may be extracted with ether, and certain ill-defined azotised compounds, which are capable of being removed by hot alcohol. The starch of wheat flour, as obtained by analysis, is always mixed with flocculi of gluten, which deposit more slowly than does the pure starch. It also retains a portion of the fat of the grain. The pure starch is composed of organised granules, principally of two sizes; the large are about the $\frac{1}{1000}$th of an inch in diameter, have a lenticular shape, and are marked by very fine, rather indistinct concentric rings. The small granules seem to be spheroidal. The granules, large and small, are quite insoluble in cold water; but, when treated with boiling water, they swell, burst, and form a viscid liquor, which, on cooling, gelatinises. The watery extract of flour always contains vegetable albumen, dextrine, and grape or fruit sugar; it is also said to contain gum, and other proximate principles may not improbably enter into its composition, inasmuch as it has never been subjected to a thorough chemical examination. The albumen of flour is a flesh-forming nitrogenised substance. When the watery extract is boiled, the albumen coagulates in flocks, just as a very dilute solution of white of egg or animal albumen coagulates under the same circumstances. In fact, the two

* See Memoir of Mr. Minton, at page 328 of the present number of the *Journal*.

substances, vegetable and animal albumen, resemble one another very closely in constitution and properties. But the principal components of the extractive are the two very closely allied substances, dextrine and sugar. Now, both of these substances are capable of being formed from starch; and, in flour, or even in the entire grain, we can, by various processes, transform the starch, first into dextrine, then into sugar. Starch is an organised substance, and may, not improbably, have been originally formed in the seed out of some saccharine juice—sugar ranking lower than starch as an organic product. But, in wheat-grain and flour, we can only regard the sugar as resulting from a reverse process, namely, from the deterioration of starch. We find that wheat-grain, when in good condition, and also most samples of wheat flour, do not contain any sugar whatever, although sugar is very speedily formed in them by the action of water. The water always acquires a feebly acid reaction, possibly due to lactic acid, or super-phosphate of lime, and seems, by reason of this acidity, to effect a transformation of the starch. If the flour be extracted with lime water, or with alcohol, this difficulty is obviated, and we are then enabled to ascertain whether the sugar pre-exists in the flour or is a product of the action of water upon it. From my own experiments I am inclined to think that the existence of pre-formed sugar in flour is very rare. I have here appended some analyses of wheat flour.

	No. I.	No. II.	No. III.	No. IV.
Gluten	9·30	10·05	11·81	4·99
Starch	66·55	64·58	62·52	61·21
Extractive	7·47	8·45	12·05	18·23
Water	14·66	15·50	12·85	15·96

Nos. I. and II. are fine well-conditioned flours; No. III. a cheap inferior flour; No. IV., a very much damaged flour.

Until very lately it was considered by scientific men that the high quality of the flour was dependent upon the amount of gluten or flesh-forming material that it contained. But it is now perfectly certain that the bread-making value of flour, and its price in the market, are proportionate—not to the amount of gluten but to the amount of starch. The finest quality of flour, that obtained from the centre of the grain, is always poorest in azotized constituents. Hitherto starch has been the baker's criterion of excellence; gluten, the physiologist's; but Messrs. Lawes and Gilbert have maintained, with considerable reason, that the baker's criterion of excellence is physiologically correct; or, in other words, that the value of bread as food depends more upon its heat-forming than its flesh-forming function. With regard to the extractives I think I may safely say that they are inversely proportionate to the good condition of the flour, as is indicated by the above analyses. A high percentage of extractives nearly always indicates some defect in the harvesting or storing of the grain or flour.

In the manufacture of bread from flour, it is usual to employ a ferment, for the purpose of generating, within the substance of the dough, thousands of minute gas bubbles, so that the resulting loaf may prove not a hard, or tough, or clammy mass, according to its degree of moisture, but a soft vesicular and easily digestible substance. Originally, leaven or stale dough was used as the ferment, but for many years past the yeast of beer has been advantageously employed as a substitute, or rather as a partial substitute. Yeast is glutinous matter in a state of change, which state of change it imparts to the gluten of the flour or dough. Independently of any yeast, however, the gluten of dough can, in course of time, attain for itself this particular transformative condition, and it then constitutes leaven. But in the production of leaven, *per se*, the dough simultaneously acquires an offensive sour taste and smell. Now, the panary fermentation consists essentially in the mutual reaction of sugar, and of gluten in a particular state of change. The gluten of yeast and leaven is in this particular state of change, and by mere contact with one or other of these substances the gluten of fresh dough readily acquires a similar state. Hence, one great use of the yeast or leaven is to put the gluten of fresh dough into an active condition, whereby it may exert a transformative or fermentative action upon the sugar. In order to effect the necessary fermentation of the sugar, some bakers rely largely upon the gluten of yeast, but in Paris, more particularly, where bread-baking has arrived at a high state of perfection, it is customary to rely chiefly upon the gluten of the dough, and only to facilitate the action by means of yeast.

We have now to consider the nature of the change which the active gluten of the dough or yeast effects upon the sugar. Grape sugar or glucose is a body having of itself very little tendency to change. It consists of carbon, hydrogen, and oxygen, and is represented by the formula $C_{12} H_{12} O_{12}$. The following table shows also the composition of several allied substances:—

$$\begin{array}{lll} & \text{Cane sugar} & \ldots\ C_{24} H_{22} O_{22} \text{ or } C_{12} H_{11} O_{11} \\ \left\{ \begin{array}{l} \\ \\ \end{array} \right. & \begin{array}{l} \text{Grape sugar} \\ \text{Fruit sugar} \end{array} & \begin{array}{l} \ldots\ C_{12} H_{12} O_{12} + 2\,HO \\ \ldots\ C_{12} H_{1} O_{12} \end{array} \\ & \text{Milk sugar} & \ldots\ C_{12} H_{10} O_{10} + 2\,HO \end{array}$$

$$\left.\begin{array}{l} \text{Starch} \\ \left\{ \begin{array}{l} \text{Dextrine} \\ \text{Leiocome} \end{array} \right. \\ \text{Gum} \\ \text{Woody fibre} \end{array}\right\} C_{12} H_{10} O_{10}$$

But the nitrogenised bodies usually classed as proteine compounds, such, for instance, as fibrin, gluten, albumen, and caseine, are remarkable for the facility with which they undergo certain spontaneous changes of decomposition, and these proteine compounds, when in this state of change, are, by mere contact, capable of affecting the condition not only of fresh nitrogenous compounds, but also of grape sugar and other varieties of non-nitrogenous organic matter. The changes induced upon this last description of bodies vary with the nature of the nitrogenised substance employed, and with its degree of decomposition. Thus, stale casein or curd converts sugar first into lactic acid, and eventually into carbonic acid and butyric acid. The active gluten of yeast or leaven converts sugar into alcohol and carbonic acid, as represented in the following diagram:—

$$\begin{array}{rl} 2 \text{ alcohol } (C_4 H_6 O_2) = & C_8\ H_{12}\ O_4 \\ 4 \text{ carbonic acid } (C\,O_2) = & C_4 \qquad\ \ O_8 \\ \hline 1 \text{ grape sugar} \ldots = & C_{12} H_{12} O_{12} \end{array}$$

Pure sugar can in this way be resolved completely into carbonic acid gas and alcohol. The object of the baker in the use of yeast or leaven, is to effect this resolution or fermentation of the saccharine constituents of the wheat within the substance of the dough. A certain quantity of flour is mixed with yeast, salt, and tepid water. This constitutes the sponge, which is covered up and set aside in a warm place to undergo fermentation. In the course of an hour or so the mass swells up considerably from the generation within its substance of carbonic acid gas, large bubbles of which gradually extend to the surface and burst. With each successive burst we have a sudden falling of the sponge, followed by a gradual rising, and these alternate actions would, if allowed, continue to take place for many hours. Various other modes of making an active sponge are employed, particularly by the use of potatoes. When the sponge, no matter how formed, is in an efficient condition, the baker mixes up with it fresh portions of flour, salt, and water, which added quantities constitute the great mass of the dough. The whole is then subjected to a thorough kneading, so that the fermenting dough may permeate and affect the entire substance, and thus cause an equable liberation

of carbonic acid in every particle. The dough is set aside for a few hours, during which the fermentation proceeds. It is then kneaded a second time and weighed out into loaves, which are allowed to continue fermenting until they have about doubled their original bulk. They are then baked in the oven, within which they undergo a further increase of size. This last increase is due principally to the expansion by heat of the previously evolved gas, for the heat of the oven very speedily arrests the process of fermentation. I have alluded to this fermentation as the panary fermentation. In reality, however, such a phrase is quite unnecessary. We have only the ordinary well-known vinous fermentation of the sugar of wheat into carbonic acid and alcohol, precisely as in making distillers' wash we ferment the sugar of the malt into carbonic acid and alcohol. That the so-called panary fermentation is in reality a vinous fermentation, was, I believe, first satisfactorily demonstrated by Mr. Graham in the year 1826, from whose paper on the subject I have made the following extract: "To avoid the use of yeast, which might introduce alcohol, a small quantity of flour was kneaded and allowed to ferment in the usual way, to serve as leaven. By means of the leaven a considerable quantity of flour was fermented, and when the fermentation had arrived at the proper point, formed into a loaf. The loaf was carefully enclosed in a distillatory apparatus, and subjected for a considerable time to the baking temperature. Upon examining the distilled liquid, the taste and smell of alcohol were quite perceptible, and by repeatedly rectifying it, a small quantity of alcohol was obtained of strength sufficient to burn and to ignite gunpowder by its combustion. The experiment was frequently repeated, and in different bakings the amount of alcohol obtained of the above strength was found to vary from 0·3 to 1·0 per cent. of the flour employed." About the same time Dr. Colquhoun also found that when fermentation had ceased in a mass of dough, through an exhaustion of the sugar present, the addition of more sugar speedily reinduced the fermentation, precisely as happens in the fermentation of distillers' wash. Many calculations have been made to show the quantity of alcohol produced in the process of bread-making. These agree tolerably well with the results of Mr. Graham's experiments, the quantity of proof spirit being estimated at less than one per cent. of the flour. Yet the total quantity of alcohol produced must be enormous. It is estimated that the quantity of bread annually consumed in London yields 300,000 gallons of spirit, all of which escapes into the atmosphere. Some years ago the military bakehouse at Chelsea became famous, in consequence of £20,000 having been expended there in the fruitless attempt to collect and condense the alcohol produced.

The above-described action of the nitrogenised substance, metamorphic gluten, upon the non-nitrogenised substance sugar, is essential to the manufacture of fermented bread, and is an object of the baker's solicitude. But flour contains other nitrogenised substances than gluten, other non-nitrogenised substances than sugar. These nitrogenised substances, like gluten, readily undergo change, and thereby acquire transformative powers, not only upon sugar and dextrine, but also upon starch. The action of the nitrogenous substance, metamorphic albumen, upon the non-nitrogenous substance starch, is highly detrimental to the manufacture of bread, and is a result which, wittingly or unwittingly, the baker endeavours to prevent. My attention was first directed to this subject between two and three years ago, when I had brought to me for examination, a loaf which was sticky, saccharine, and sodden throughout, but which had been made from apparently good flour. Again, in the autumn of 1856 I received from Tring, in Hertfordshire, a sample of flour which was unadulterated, which contained the usual proportions of gluten, starch, and extractive, the latter being perhaps rather in excess, which seemed to be in good condition, inasmuch as the gluten was highly elastic and expansible by heat, which had in fact only one fault—it would not make bread. The result of the baking was a sweet, sticky, dark-coloured mass. Subsequently, through the kindness of Dr. Hillier, Mr. Pittard, and other friends, I have received several samples of flour having similar characters. Now, in these samples there occurs, during the process of bread-making, an exaggerated degree of the change which always takes place to a slight extent, and which consists in the conversion of the starch into sugar and dextrine. Mr. Warren de la Rue tells me that he has met with samples of flour in which this transformation of the starch has taken place so rapidly and completely as altogether to prevent the formation of paste for use in his manufactory. Many years ago Vogel noticed that, in the manufacture of bread from flour, although much sugar was converted into carbonic acid, and alcohol, the quantity of the sugar in the loaf nearly equalled that in the flour. But soon after, Mr. Graham and Dr. Colquhoun both showed that, during baking, a portion of the starch of flour was converted into sugar. Now this conversion is due to the presence of some albuminous ferment. We meet with certain metamorphic albuminous or caseous substances, both animal and vegetable, which agree in the circumstance of their being soluble in water, precipitable by alcohol, and inoperative after exposure to a boiling heat. Such, for instance, are the following:—

Diastase	from	malt,
Cerealin	,,	bran,
Emulsin	,,	almonds,
Ptyalin	,,	saliva,
Pepsin	,,	mucous membrane,

and many other ill-defined products. Diastase, cerealin, and ptyalin are remarkable for the rapidity with which they convert starch into dextrine and sugar. The finest wheat flour, obtained from the central portion of the grain, consists almost wholly of starch, is very free from azotised substances, and, unless badly harvested or stored, has very little tendency to undergo this change. But coarse flour obtained from the exterior of the grain, is rich in azotised substances, and more ready to undergo the glucosic deterioration, which is dependent upon an altered condition of the albumen. During the process of germination we always find the albumen of the seed to take on this condition. The process of malting consists in effecting a germination or sprouting of the barleycorn, coincidently with which the albumen of the barley undergoes a change, acquires transformative powers, receives the name of diastase, converts the starch of the seed into sugar, and is capable of effecting the same change upon a large additional quantity of starch. Now, the albumen of all wheat that has undergone a damp harvesting, or that has been sprouted from any subsequent cause, is in the condition of diastase. English wheat is very liable to suffer in this manner, and a large quantity of the wheat imported into London is in a similar condition. Dr. McWilliam, the physician to the Custom House, tells me that it is usual for a lighted candle, let into the hold of a vessel laden with corn, to be extinguished by the carbonic acid resulting from the partial germination of the cargo; and that, only a few weeks back, a man nearly died from sleeping in a cabin in which a wheat cargo was germinating. Now, wheat of this kind yields a flour from which it is scarcely possible to manufacture a presentable loaf, save by the use of some corrective agent. Moreover, when flour made from well-harvested wheat is subsequently exposed to heat and moisture, the albumen becomes metamorphic, and the production of white bread impracticable, owing to the conversion of the starch into sugar. M. Mège Mouriès has recently shown that the albuminous constituent of bran is very ready to undergo metamorphosis, and to acquire transformative powers. To the substance in this condition he has given the name of cerealin, which, however, appears to be identical, or

very nearly identical, with ordinary diastase. He shows clearly that the brown colour of bread made with pollard or fine bran, is not due to the particles of bran, but to the circumstance of the cerealin effecting a conversion of the starch into dextrine or sugar. When this conversion was prevented by means presently to be described, the bran bread had a very pale orange colour, quite different to that of ordinary brown bread made by the usual method. The crumb of the bread was coloured yellow, merely by the small particles of bran disseminated through the mass.

In confirmation of M. Mège Mouries' views, a fact is recorded by Chevreul, in his report on the subject, to the effect that "a method was proposed to the French government, by means of which the whole of the flour in wheat was to be converted into white bread. This method consisted in removing the coloured skin of the grain, and it was supposed, in accordance with the prevailing opinion, that when all the coloured portions of the grain were separated, the bread obtained would be white. This method was tried, and, to the astonishment of all parties, the bread obtained was brown." The whiteness of bread does not depend solely upon the whiteness of the flour, but in great measure upon the little degree of change which the starch undergoes in baking. I have taken the finest flour, which in the ordinary way yielded unexceptionable bread, and have had it kneaded with infusions of bran and malt instead of water. The resulting loaves have corresponded exactly with those made from sprouted wheat in being brown, sticky, sweet, and scarcely eatable, owing to the conversion of the white starch into a brown sticky mixture of dextrine and sugar. In bread of good quality, the starch has undergone very little alteration. A portion of it is rendered soluble in water, but the great majority of the granules are simply swollen, not burst, and may be washed out of the bread, collected, and weighed. Vogel gives the following analysis of a wheat bread loaf:—

Sugar	3·6
Altered starch	18·0
Unaltered starch	53·5
Gluten, with some starch	20·7
	95·8

I have never estimated the amount of unaltered starch in bread, but I have frequently collected it and examined it microscopically.

Between the most perfect flours and such sprouted specimens as cannot of themselves be manufactured into a saleable bread, we have innumerable intermediate varieties. Now, it is not by any means certain that the glucogenic varieties of flour are of necessity inferior to the finest flour in their nutritive and digestive properties. There is reason to believe that all starch in its passage through the alimentary canal becomes converted into glucose or an allied substance; and there is no reason to believe that the commencement of this change out of the body is in any degree objectionable. But these flours, in proportion to their glucogenic tendencies, do not make good bread, and it becomes an object with the baker to oppose the glucogenesis as much as possible. Hence, in making bread from certain kinds of flour, he finds it necessary to add alum, or lime, or bean-meal, or some corrective substance which, from experience, he knows will cause the flour to yield a loaf presentable to the eye and agreeable to the palate. In reference to the so called adulteration of bread with alum, I need scarcely remind the members of the Society of Arts that they are not required to believe everything they have heard from the lips of gentlemen who, gasping for notoriety, have raised a popular clamour on the subject, have ascribed to themselves exclusive knowledge, and claimed for themselves instinctive infallibility. On scarcely any topic, perhaps, has there been expended so much bad chemistry, loose speculation, and, I fear, groundless defamation, as upon that of alum in bread. One gentleman, who, from his vast knowledge, felt himself impelled to write a book on the subject, describes in great detail not only how he found alum in bread, but also how he ascertained the quantity, and that by a process which could not possibly have yielded him a single particle. Another gentleman, probably of greater knowledge, inasmuch as he was impelled to write two books instead of one, disclaims altogether the process above alluded to, but bolsters up his own demands on public credulity by quoting the monstrous results obtained by its means. His predecessor, when he wished to weigh alumina, weighed a something or other without any alumina whatever; but he, more wise in his generation, does not omit the alumina, but takes care to weigh it with a good deal of something else in addition. When in a court of law a scientific witness affirms that he has detected arsenic, he is required to show that the results he obtained could not be due to any other substance than arsenic. But the alum detector of the present day contents himself with getting a whitish precipitate, which may be alumina or may be something else. Why should he trouble himself about a baker's reputation? The means for detecting and estimating alumina are of course equally certain with those for detecting and estimating arsenic; but I know of no book, devoted to food adulteration, in which a satisfactory process is given, though I admit that, in some of these books, the processes are so loosely described as to leave the authors a loophole of escape from the charge of positive error.

In illustration of the above statement, I beg to direct your attention to the following table, which exhibits the results of an examination of wheat grain and other vegetable produce.

	Number of Samples Examined.	Grains of ash used.	Precipitates formed.
Wheat	23	49 to 100	10
Bran	1	25	1
Maize	1	52·1	0
Barley	3	50	0
Wheat Straw	6	100	6
Barley Straw	3	100	0
Mangold-wurtzel bulb	2	100	0
Swede Turnip bulb	3	50	0
Swede Turnip leaf	4	25 to 54	4

The ashes were all kindly furnished me by Dr. Gilbert. The incinerations were made at the Rothamstead laboratory, and all who are acquainted with that laboratory must acknowledge the great care with which every operation is there conducted.

My object was to ascertain whether the process usually recommended for the detection of alum in bread, would not also detect alum in wheat grain and other vegetable produce that could not possibly be adulterated. The process I adopted is that known as Kuhlmann's, which is described as follows: I quote from Mitchell's "Treatise on the Falsifications of Food." "Incinerate about half a pound (3,500 grains) of bread in a crucible, and after having pulverised the ash, treat it with nitric acid. Evaporate the mixture nearly to dryness, dilute with about half an ounce of water (distilled), and add to the whole an excess of caustic potash solution; boil and filter; neutralise the filtered liquid with hydrochloric acid, and add a slight excess of ammonia. Collect the alumina thus precipitated in a filter, wash, dry, ignite, and weigh it. Every 100 grains of alumina correspond to about 467 grains of alum." Now, this is the process I adopted in my examination of the above ashes, save that in many cases I employed hydrochloric instead of nitric acid, such being, I believe, the usual practice, and what was the result? Why, out of 46 examinations I obtained in 21 instances the celebrated white precipitate, said to

be indicative of alumina and alum; so that had these samples been in a manufactured instead of the natural state, had the wheat, for instance, been made into flour, I should have been justified, according to the authority quoted, in pronouncing it to be adulterated with alum. But a subsequent examination of the precipitates I obtained, shewed that in reality they were not due to alumina at all. M. Kuhlmann's process, as above described, is possessed of rare merits. It will never fail in detecting alumina when present, and will often succeed in detecting it when absent also. The idea of weighing this *olla podrida* of a precipitate, and from its weight calculating the amount of alum present, as is gravely recommended by great anti-adulteration adepts, is too preposterous to require a moment's refutation.

Last year, a London physician wrote a letter to the *Lancet*, wherein he stated he had found nearly an ounce and a half of alum in a 4lb. loaf obtained from a very noted baker, being at the rate of 8lbs. of alum to a sack of flour; and yet the ash of this bread amounted only to 1·17 per cent., including more than 0·5 per cent. of common salt. The ash of 500 grains of bread, in which 11·37 grains of alum were detected, yielded him only 1·4 grains of sulphate of baryta, though every chemist knows it ought to have yielded more than 11 grains, inasmuch as a grain of alum furnishes very nearly a grain of sulphate of baryta; and the presence of so much common salt, of course negatives the notion that sulphuric acid had been expelled to any great extent by the incineration.

If we have had curious methods described for the detection of alum, we have also had curious statements as to the chemical effects which it produces. About twelve months ago, a very ingenious friend of mine published a report on the subject of alum in bread, and a still more ingenious gentleman so highly approved of it, that he caused the major part to be published in divers newspapers, with his own name appended at the bottom in the large capitals usually considered indicative of authorship. Well, in each of these Siamese-twin reports—for the second had no separate individuality—we have the following daringly-imaginative explanation of the effect of alum in panification:—"The chemical action of alum on moistened flour is analagous to tanning, and destroys (*pro tanto*) a considerable portion of its nutritiveness by converting it into a kind of wash-leather, or spongy India-rubber. This gives it a tenacity, or toughness and firmness, enabling it to retain the thousands of little bubbles (given off by the yeast) which constitute the lightness or sponginess of the bread." I should have much liked to have shown the members of the Society of Arts some of this wonderful spongy, India-rubber, wash-leather gluten, which two gentlemen, unknown to one another, were clever enough to obtain from alumed bread. Unfortunately, however, my own experiments for its preparation were not crowned with success.

Now, from actual experiment, not from speculation, I think myself justified in saying that one very important use of alum is to prevent any undue deterioration of the starch during the process of raising and baking. If we mix a solution of starch with infusion of malt, in the course of a few minutes only the starch can be no longer detected, being completely converted into dextrine and sugar; but the addition of a very small quantity of alum either prevents altogether, or greatly retards, the transformation. The action of diastase upon undissolved starch is very gradual, but here also the interference of the alum is easily recognizable. Bread made with infusion of bran or infusion of malt is very sweet, sodden, brown-coloured, and so sticky as almost to bind the jaws together during its mastication. But the addition of alum to the dough causes the loaves to be white, dry, elastic, crumbly, and unobjectionable, both as to taste and appearance. I have found that flour, which of itself was so glucogenic as to yield bread undistinguishable from that made with infusion of malt, could, by the addition of alum, be made to furnish a white, dry, crumbly, eatable loaf. Dr. Hillier, if present, will probably remember my sending him two loaves made from a sample of glucogenic flour with which he had supplied me; the one, without alum, being brown, wet, sweet, and sticky, the other, with alum, being white, dry, crumbly, and unobjectionable. The specimens on the table exhibit the same differences in appearance. Of course, the worse the character of the bread which the flour yields *per se*, the more striking the effect of the alum. Now, that alum does oppose the transformation of starch into sugar, during the process of bread-making, is indisputable, and this action is quite sufficient to account for the whiteness, the dryness, and the non-adhesiveness that result from its employment.

Alum is said to have the power of causing bread to retain a larger proportion of water than it otherwise would. Thus, one witness, before the Select Parliamentary Committee on the Adulteration of Food, said, "supposing it could be proved that the presence of alum in bread is not directly injurious to health in any way, yet certain objections would still remain to the employment of alum; one of those objections is, that it causes the bread to hold more water than it would otherwise do, and, of course, the greater the quantity of water the less the quantity of wheat flour." And another witness said that, "bakers who used alum defrauded their customers by selling water at the price of bread." These statements certainly do not accord with my experience. I once examined the new crumb of eighteen alumed loaves, and found as a mean result 43·68 per cent. of water. I also examined, in a precisely similar manner, the crumb of seven non-alumed loaves, and found as a mean result 42·78 per cent. of water, the difference being quite insignificant as compared with the differences which subsist between the individual loaves, whether alumed or not.

The table, given on the next page, shows the detailed results. The specimens marked with asterisks did not contain alum. The table also gives the per centages of nitrogen and ash. The loaves were all two-pound loaves, obtained new, that is to say, during the day on which they were baked. The top crust of each loaf was sliced off, and then a layer, about two inches thick, removed, trimmed at the edges, and submitted at once to examination. My estimations of water accord closely with those of Payen and Johnston, but are somewhat higher than those of Lawes and Gilbert, of Maclagan, and of Christison. The mean of my nitrogen determinations corresponds closely with the results of Lawes and Gilbert, Maclagan, Playfair, and Payen.

Another reputed effect of alum is to prevent the loaves turning sour or mouldy. On this point I have no experience to lay before the Society. M. Mège Mouries lays considerable stress upon the fact that when the fermentative action of the gluten preponderates, we have sugar converted into carbonic acid and alcohol, as is desirable: but that when the fermentative action of cerealin, and, I would add, of diastase, preponderates, we have starch converted into dextrine, sugar, and lactic acid, as is most undesirable. We should infer chemically that alum, by preventing the transformation of starch, would prevent or interfere with the production of lactic acid, which seems to be produced in recognisable quantity when bread is made from inferior flour. Some of my friends, who make their own bread, have informed me that alum is necessary to prevent mouldiness, and evidence to the same effect was given before the Parliamentary Committee. We know that alum is usually added to flour paste to make it keep, but whether its preservative power depends upon its preventing the paste from liquefying by an alteration of its starch, or merely upon its preventing mouldiness, I am unable to say.

Liebig's explanation of the effect of alum in panification, corresponds as far as it goes with that which I have had the honour of presenting to your notice. Liebig says that in damp flour there is produced, by a re-action

of the gluten and starch, acetic and lactic acids, which render the gluten soluble in water, and that alum and

	Price in Pence.	Per centage of Water.	Per centage of organic matter	Per centage of mineral matter or ash.	Per centage of ash in dry Bread.	Per centage of Nitrogen in new Bread.	Per centage of Nitrogen in dry Bread.
1	$4\frac{3}{4}$	43.03	55.48	1.49	2.61	1.83	3.21
2	$3\frac{1}{2}$	42.86	56.07	1.07	1.87	1.47	2.57
3	$3\frac{1}{2}$	44.81	53.74	1.45	2.62	1.89	3.42
4	$3\frac{1}{2}$	46.71	52.12	1.17	2.19	1.14	2.13
5	4	45.42	53 24	1.34	2.45	1.66	3.05
6	4	44.33	54.29	1.38	2.47	1.04	1.88
7*	4	44.41	54.38	1.21	2.17	1.06	1.90
8	$3\frac{3}{4}$	38.62	59.79	1.59	2.58	1.15	1.47
9*	$3\frac{3}{4}$	42.77	56.00	1.23	2.15	1.31	2.29
10	4	43.67	55.09	1.24	2.20	0.93	1.66
11*	$4\frac{1}{2}$	42.94	55.82	1.24	2.17	1.12	1.95
12	$3\frac{1}{4}$	44.20	54.61	1.19	2.13	1.14	2.05
13	4	45.12	53.55	1.33	2.4	1.17	2.15
14	$3\frac{1}{2}$	44.34	54.41	1.25	2.28	1.23	2.21
15	4	43.70	55.07	1.23	2.18	1.01	1.81
16	$4\frac{3}{4}$	43.06	55.59	1.35	2.39	1.24	2.18
17	4	43.90	54.92	1.18	2.11	1.13	2.03
18	4	42.12	56.65	1.23	2.12	1.23	2.14
19	$4\frac{3}{4}$	42.58	55.99	1.43	2.50	1.34	2.34
20*	$4\frac{3}{4}$	41.06	57.23	1.71	2.90	1.39	2.38
21*	$4\frac{1}{2}$	44.07	54.67	1.26	2.26	1.08	1.94
22	4	44.46	54.22	1.32	2.38	1.18	2.14
23	$4\frac{3}{4}$	43.43	55.24	1.33	2.35	1.19	2.10
24*	$4\frac{1}{2}$	42.89	55 68	1.43	2.52	1.17	2.05
25*	4	41.34	57.76	0.90	1.54	1.33	2.27
		1085.84	1381.61	32.55	57.57	31.53	55.72
Mean.	4	43.43	55.26	1.30	2.30	1.26	2.22

other mineral salts render this gluten again insoluble. Although Liebig referred specially to the dissolved gluten, I have no doubt he really meant to include all the dissolved proteine or albuminoid substances, including, of course, the diastase and cerealin. But he does not seem to have deduced, or, at any rate, he has not referred to the consequence which would necessarily arise from this action, namely, the prevention of the metamorphosis of the starch during baking. Payen seems to entertain the same idea as Liebig. He says that "when wheat has been badly kept, or when the moist flour has become altered during its warehousing or transport, from three to six thousandths of alum are occasionally added, so as, in some degree, to restore to the gluten the consistency that it has lost." In the absence of any evidence, either from fair inference or direct observation, that the introduction of small quantities of alum into bread is prejudicial to health, it seems that the practice is not so reprehensible as is usually maintained. It certainly improves greatly the quality of bread made from inferior flour, and, in a politico-economical point of view, is important, inasmuch as it renders a large quantity of flour suitable for human food in the form of bread, which flour would otherwise have to be devoted to less important uses.

Another chemical agent, namely, lime-water, has been recommended, to effect the same result as that now accomplished by means of alum. This substance was originally recommended by Liebig, and has been used, I believe, to a considerable extent by the Glasgow bakers. Now, I would seriously advise London bakers to give lime-water a full and fair trial. Of course they know exactly how to use alum, and they would have to learn by experience how to use lime. Hence, if their earlier trials are not completely successful, they should, nevertheless, persevere. From laboratory experiments I find that lime water acts quite as efficaciously as alum in preventing the action of diastase, and the consequent transformation of starch into sugar. It seems to have scarcely any action upon the fermentation induced by yeast, or, at any rate, a much less action than alum, which, undoubtedly, retards the process somewhat. It yields a very white agreeable bread, having a rather more porous texture than ordinary bakers' loaves, and being quite free from any sourness of taste or smell. The acidity of dough, independently of its obvious disadvantages, facilitates greatly the deterioration of the starch. Starch is always converted into dextrine by a sufficient elevation of temperature—about 320 deg. Fahr., and hence, the crust of bread usually contains as much dextrine as starch. But the presence of a small quantity of free acid enables the transformation to be effected at a lower temperature, and two processes are now followed for the manufacture of dextrine upon this principle—that of M. Payen, who uses nitric acid, and that of Mr. Crace Calvert, who uses sour butter-milk, the acidity of which is probably due to the same substance as is that of dough, namely, to lactic acid. While strongly recommending the use of lime-water, I yet fear that, in the practical operations of the bakery, it will prove not quite so effectual as alum in improving very inferior flour, and chiefly because it will not be possible to introduce so large a quantity into a loaf, inasmuch as a pint of water can only dissolve about 12 grains of lime. Of course, the use of lime-water will constitute an adulteration, and be stigmatized as highly immoral, inasmuch as it will enable the baker to improve the appearance of an inferior flour. Moreover, although recommended by Liebig, it will render the phosphates insoluble, and so be open to another whimsical objection. But the detection of this adulteration with lime will, I conceive, be more of a puzzle to those gentlemen who have played with the alum-question, and who have not thought it immoral to palm off their bad chemistry as a very superior article. There are, doubtless, many other mineral salts that have the same kind of action as alum, though different in degree. Thus, sulphate of copper seems to act very powerfully. I have found the addition of sulphate of zinc to yield a very white loaf; and even gypsum is not altogether without effect. An admixture of bean meal is said to exert the same action on the flour of badly-harvested wheat, as is exerted by alum. Dr. Gilbert inform me that such is really the case, but it is a point on which I have no personal experience. M. Mège Mouries, in his new process of bread-making, whereby all the meal of wheat is to be converted into wheat bread, effects the neutralisation of the cerealin by fermenting the brown meal with water in which sugar and yeast have been subjected to the alcoholic fermentation. This process prevents wholly, or to a great extent, the lactic acid fermentation that would otherwise be induced by the cerealin, and it also makes the bran to be thoroughly separated from the meal adhering to it. Then the white flour is kneaded with the fermented liquid which contains the sediment of flour separated from the bran, so as to produce a mass of dough which represents the whole farinaceous portion of the wheat. By the process of M. Mège Mouries, the deterioration of the starch is said to be prevented, and the yield of white bread from a given weight of wheat largely increased, inasmuch as the whole of the wheat is eventually separated into two products only, namely, the coarse-bran, and the fine bread. The processes are fully described in the *Compte Rendus*, for January 12th, 1857, and a very excellent abstract was published in the *Pharmaceutical Journal*, for November 1857. And now, in conclusion, I have only to thank you for your kind attention, and to express a hope that I have succeeded in rendering a common-place subject not wholly uninteresting or uninstructive.

DISCUSSION.

The Chairman said they must all have felt, whilst

listening to the admirable paper of Dr. Odling, that he had introduced a most important subject, in which they were all, more or less, directly interested. It was one which, within the last few years, had engaged the attention of many scientific men, and with very different results. There was much difference of opinion as to the latter point touched upon by Dr. Odling, namely, the adulteration of bread, as well as on the changes which took place in the process of bread-making. He saw a number of gentlemen present who were acquainted with the subject, and he hoped, as this was a favourable opportunity, the subject would be fully discussed, so that those who had held that adulteration of bread had been practised to a dangerous extent, might, if this opinion were shown to be unfounded, be relieved from further anxiety on the subject, and also that those who had held that such adulteration had not been extensively practised, might, if this were proved to be an error, be put upon their guard upon learning that considerable adulteration had taken place.

Dr. Normandy had listened with considerable interest to the clever and entertaining paper of Dr. Odling. He would address himself to the question of the adulteration of bread with alum, and he would first of all speak of the process which chemists, who knew what they were about, adopted as a test of the presence of alum in bread. It was not a process of his own contrivance, but that suggested by Kuhlmann, and which he (Dr. Normandy) had slightly modified. In his opinion that process, thus modified, was the only one which could be relied upon for the detection of alum. He would recite the process of Kuhlmann, and also mention the modifications which he conceived necessary to give unexceptional results. The process which he followed was this:—He took 1,500 grains of bread from the middle of a loaf, cutting off the crust—not that it was strictly necessary to do so—but in order to have the most convenient material to burn and crumble, the crust should be cut off. These 1,500 grains of bread he cut into thin slices, placed them on a platinum tray, and exposed them to a cherry-red heat until they became charred. When completely charred, which was known by the slices no longer burning with a flame or evolving unpleasant fumes, he took this charcoal, ground it in a mortar into a fine powder, and then returned it to the platinum tray, and exposed the powder to a cherry-red heat until it was reduced to a grey ash. He then withdrew the lamp, and moistened the grey ash with a solution of nitrate of ammonia, and applied again a red heat to the mass for the purpose of burning the last portions of charcoal remaining. Then he poured upon the ashes in the tray a few drops of hydrochloric acid sufficient to moisten them, and, in the course of a minute or two, he washed the whole in a porcelain capsule, and evaporated to absolute dryness, in order to render the silica perfectly insoluble. That was the slight modification which he considered necessary. The perfectly dry residue was then boiled in the porcelain or silver capsule with dilute caustic potash, and the whole was then thrown on a filter, and after slightly supersaturating the strongly alkaline filtrate with hydrochloric acid, carbonate of ammonia was added in excess to the filtrate thus slightly acidified, and if a white precipitate was produced, it was very probable, indeed, that it was alumina; and if, taking that white precipitate, washing it, and treating it before the blow-pipe with nitrate of cobalt, the result was an *unfused* mass of a beautiful blue colour, then he said that substance was alumina. Through the kindness of Dr. Gilbert he had obtained thirteen samples of ashes, produced, most likely, under the same conditions as those supplied to Dr. Odling, and produced, if he recollected rightly, from wheat grown in the seasons of 1849 down to 1856. He examined all of them, and on treating them in the way he had described, he did not discover the least trace of alum, nor was there a vestige of white precipitate produced after standing for twenty-four hours. With reference to the prosecutions which had been instituted against bakers for using alum in their bread, he, as a chemist, had nothing whatever to do with the question whether alum was injurious or not to the human system. His business was to answer the question put to him, "Is there alum in this sample of bread, or not?" In most cases of such prosecutions, the parties denied the use of alum, but, after analysis had proved its presence, they all had admitted that they had used it; and, moreover, alum had been seized on most of their premises, either by itself or mixed with the salt they used in the manufacture of the bread. That was sufficient, he thought, to set at rest all surmises on the subject. They might say it was impossible that alum could be present, but there it was. His invariable practice, in cases of prosecution where he was called in, was, to advise the parties to impound the bread to be analysed by another chemist, but, except in one instance in which his analysis had after all been confirmed by that of another eminent chemist, they had never availed themselves of the offer, and, as he had just said, had afterwards acknowledged that they had used alum. It had been urged that there was no positive evidence that the habitual use of alum in bread was or was not injurious; he was not called upon to decide such a question: whether it was injurious or not was a purely medical question, which it was the province of medical men to answer; all he could say was, that if they were to wait for positive evidence of the mischief caused by the use of objectionable things, there was scarcely anything the removal of which would not be successfully resisted. He had never heard of a case of a person actually dying from drinking Thames water, or that any one had been positively killed by the effluvia from the house drains. Were we, then, to leave these and other abominations undisturbed? Surely, if it was known that, when a certain substance was taken internally, its effect was to disorder the organs of digestion, we might, without great violence to our reason, say that the many cases of dyspepsia and other diseases, the origin of which was obscure or unknown, might be referred to the constant introduction, day after day, and year after year, of that substance into our food. At the same time it was necessary to be careful, before charging persons, of otherwise undoubted probity, with using deleterious substances in their manufactures, when the character of such persons depended upon the truth of such a charge; but this was another question, and, as far as he was concerned, it was a satisfaction for him to know that all the persons who had been fined in consequence of his evidence, had admitted the accuracy of the charge by pleading guilty either at once, or at some more advanced part of the proceedings. These explanations, he thought, would suffice for the present. As to the sheer incredulity with which the assertion had been met, that alum had upon two occasions been found in bread, actually in the shape of crystals, and the alleged extravagance of the fact, he had only to say, that, however unlikely this might appear, it was a fact for all that; and however clever might be the reasons adduced in proof of its improbability, these reasons were hardly sufficient to charm away that which was actually found, seen, touched, examined, and identified as alum, not only by him (Dr. Normandy) but by other chemists, whose reputation for skill and truthfulness stood at least as high as that of those incredulous persons who, however, did not venture to deny that alum was, or, until quite lately, had been used by almost all bakers, for that, unfortunately, was also a fact too well established to be in any way disturbed. With respect to the process of M. Mège Mouriès alluded to in the paper, he did not think that M. Mège Mouriès attributed the dark colour of the bread to the action of cerealin upon the starch. It appeared that the cerealin which existed in the perisperm of the grain, in the bran, acted upon the gluten, which it softened,

and rendered somewhat emulsive and dark, whereby a peculiar grey colour was imparted to the bread, a colour, however, unlike that of the English brown bread, which was made by an admixture of bran, and for which the name of "bran bread" would perhaps be more appropriate. The *pain bis* or grey bread of France was made from flour of second quality, mixed or not with rye flour, but there could be no question that it was the action of the cerealin upon the gluten, which, in a great measure, imparted that peculiar colour to the bread.

Dr. Snow said that allusion had been made in the paper to a statement made by him in the *Lancet*, as to the quantity of alum he had found in bread supplied by a baker in a fashionable locality. He at the same time stated that he found much less alum in the bread supplied to the lower classes, though he had fully expected that what were called cheap bakers used more than those who supplied the inhabitants of May-fair, but such was not the case. Dr. Odling had expressed his doubts as to the quantity of alum he had detected in the bread. There might be some slight error, but he was pretty sure he (Dr. Snow) was right on the whole. He had a portion of the same bread left, and at a future time he should resume his investigation of the subject, and if he found that he had been wrong in the quantity of alum he had stated it to contain, he would acknowledge his error. He had many years ago come to the conclusion that the practice of putting alum into bread was a fruitful source of rickets amongst children, but he had not published his opinions on that subject. It appeared to him that rickets were more prevalent amongst children in London and the south of England than was the case in the north or in Wales, where the children were just as overcrowded and as deficiently supplied with milk as in London. The rickets were imagined to arise from a deficiency of the phosphate of lime or bone-forming ingredients in the food of the children. The bones of a child could only be hardened by the food administered to it. In the majority of cases among the working classes the chief food of the children was bread. Liebig had stated that when alum was mixed with bread the phosphate of lime in the flour was decomposed, and an indigestible phosphate of alumina was formed; and that went to show that in the great article of food of the working classes the substance necessary for the hardening of the bones of the children did not exist. He did not consider this as the sole cause of rickets in children, because it might occur from a morbid excretion of the phosphate of lime which ought to be taken up by the system. When children were supplied with sufficient milk, or eggs, or potatoes, that would assist to harden the bones. He was sorry to hear the suggestion of the use of lime-water as a substitute for alum in bread, because it would have a similarly injurious effect. It could not be denied that alum was of great advantage to the bakers in the making of bread, but it was very probable that they might find out some other ingredient equally valuable in its chemical operation, without the injurious properties of alum. He believed, however, that for grown people the admixture of a little alum was not very injurious, though for children it was so.

Mr. Pittard said, having been indirectly alluded to as a writer on the subject of adulteration of food, he would offer one or two remarks. Dr. Odling's paper had put before them the novel and interesting discovery of the formation of a large quantity of sugar in flour of an inferior quality. It had long been known that a large quantity of sugar was found in wheat when in a state of germination, but now they had the additional fact that it was also found in flour, and it was also interesting to know that alum prevented its formation. For these reasons the paper was a valuable and instructive one. He (Mr. Pittard) had—perhaps unfortunately—stated that the effect of alum in bread was analogous to tanning, and converted it into a substance like wash-leather. They knew that if paste was made too thin, and alum was mixed with it afterwards, it made it thicker, and it was also known that borax possessed similar properties. Those facts put together, went to show a similar action to tanning. He (Mr. Pittard) was still by no means convinced that the alum did not tan the gluten of the flour. Dr. Odling had certainly gone far to say that it tanned the diastase, and had carefully abstained from saying much as to the effect, bad or good, produced by it on the human body. For his own part he and many other medical practitioners had a settled belief that alum in bread was injurious to mankind. Sickly children had been found to improve marvellously upon baked flour, whilst they pined away upon soaked bread. The chemists spoke slightingly of the medical men because they did not pretend to know the chemistry of the question, and said that they were ignorant that the alum was decomposed in the making of bread. Even if that were so, it did not prove that the alum was rendered innocuous; if alum was resolved into alumina and sulphuric acid, he did not know whether alumina might not be injurious in the body. It was a fact worthy of note that, although alumina was one of the most plentiful substances on the earth, yet it did not enter into the composition of any organic bodies whatever, whether animal or vegetable. This alone was a reason against the introduction of alum into food. With salt it was very different. They might be told that the chemical effects of alum on the animal system were not extraordinary, but there were chemical effects to be considered. Finely pulverised glass would cause the death of an animal, and yet no one would assert that it was a powerful chemical substance, though the mechanical effect upon the intestines of a dog on which the experiment was tried, was sufficient to kill it. Dr. Odling had told them it was convenient to the bakers to use alum. No doubt of that. It might make nice looking bread, but if it did great injury to those who ate this bread, it ought not to be used, any more than pernicious colouring ingredients should be used in other articles of food.

Mr. Varley begged to add his testimony to that of Mr. Pittard with regard to the pernicious effects of alum upon the human system, as he had found from personal experience. With respect to the admixture of alum with paste to prevent mildew, he had found that longer boiling of the paste had the same effect, whilst the action of alum on delicate tints of colour was obviated.

Mr. Johnstone mentioned that during a harvest some years ago the wheat had been got in in very bad condition. The question was discussed by Professor Faraday and others, and they came to the conclusion that carbonate of magnesia would have a most beneficial effect upon it in making bread, and this would no doubt have been adopted had it not been for the expense. For many years he had used in his family bread made with hydrochloric acid and bi-carbonate of soda, which was most excellent.

Mr. T. A. Malone said it had been mentioned that bakers had placarded their bread as having "all the gin" in it,—on the same principle let them now announce, "bread with alum in it," and people could then exercise their choice whether they would have it or not. He thought that would be the most honest way of dealing, because if the addition of alum to inferior flour made bread more presentable to the eye than that made from the best flour without alum, it was a species of fraud that ought not to be countenanced. They were told that it was still an open question whether or not alum was injurious to the human system. The same doubt prevailed with regard to the emanations from sewers, but as all sensible people avoided open sewers as much as possible, so he for his own part would wish to avoid bread with alum in it. Dr. Normandy had told them that if he obtained from the white precipitate a blue colour before the blow-pipe by the addition of cobalt, he was entitled to consider that it contained alumina, but it was known

that other matters became blue by the action of cobalt besides alum.

Dr. Normandy said it was the precipitate, obtained in the way he had described, which should be submitted to the nitrate of cobalt; and if a blue colour were obtained he felt certain that this test could be practically relied upon.

Mr. Malone added that the potash employed might allow some of the phosphates to remain, and these would give a blue colour. He believed that, unless the final precipitate were completely re-analyzed, they were not entitled to speak with certainty as to its composition.

The Chairman said some of the phosphates of alkaline earths were soluble in potash.

Mr. Malone said it had been stated that alum rendered bread light and friable; he was not sure that that was any recommendation in point of digestibility, and he was doubtful whether a more sodden mass would not be more soluble in the stomach. Milk became a coherent mass very soon after it was received into the stomach; he thought this was a point worthy of further consideration.

Dr. Gilbert said, that the subject of the propriety, or otherwise, of adding alum, and certain other matters, with the same object, to bread, was one of such great practical importance, that while there were others, as he saw there were, in the room, who had been much occupied with the question, and had not yet spoken, he felt it to be almost an improper digression to lead the attention of the audience in another direction. In obeying the call of the Chairman, he would, therefore, be very brief on the points with which he was himself best acquainted. With regard to the alum question, he suspected the truth lay somewhere between the two extremes which had been advocated by the respective speakers. He was not disposed to think that alum could be, with advantage to the consumer, added to really good flour, for the purpose of bread-making. On a large class of constitutions he thought there was medical testimony enough to show, that alum, or alumina, in bread acted injuriously. With such it induced constipation, and this was a fruitful source of more serious disease. On the other hand, it was to be remembered, that owing to the seasons, which we could not control, a considerable portion of the flour, which must be consumed by somebody, was not in a perfect condition to yield a bread of good texture and other requisite characters without the aid of some extraneous matter; and if the bread were not of suitable texture and condition, its digestion would be imperfect, and if digestion, then assimilation also. The question was then, so far as related to alum, whether or not the benefits which it undoubtedly produced, so far as the physical and some other characters of the bread were concerned, were greater or less than the evils he believed it in many cases induced. The subject required much careful consideration, and if a substance or a method, that would have the same effects in retarding the chemical changes to be avoided in flour and bread, and which at the same time was undoubtedly innocuous could be generally adopted, few would then uphold the use of alum. The suggestion of Dr. Odling to use lime-water, as recommended by Baron Liebig, was deserving the serious attention both of bakers and medical men. Dr. Odling had quoted the opinion of Mr. Lawes and himself (Dr. Gilbert), to the effect that the best flour in the estimate of the baker was that which contained a comparatively small proportion of gluten or other nitrogenous constituents, and a large amount of starch; and, further, that this estimate was a correct one, so far as the consumer of the bread was concerned. This was, in fact, the case, as matters stood; but some little amplification of the statement was needed, to avoid misunderstanding. He would not say, that a comparatively high per centage of gluten was not desirable, provided the flour had also all the other qualities requisite in a good bread flour. These depended much on physical character and chemical condition, as well as on ultimate chemical composition. Thus it happened that our home-grown wheats, and many grown under somewhat similar climatic condition, seldom at once ripened well, and yielded a high percentage of nitrogenous compounds. There were exceptional seasons; but the average was as here stated. Our wheats which ripened best were generally low in percentage of nitrogen, and high in that of starch; and the high condition, with little tendency to fermentative changes, was of more importance than the richness in nitrogen, within the limits usually occurring. The highly glutinous wheats, on the other hand, from hotter summers than our own, generally were structurally objectionable for the purposes of bread making, except in small proportion, with less matured wheats. These highly nitrogenous grains were generally very hard, refractory in the mill, not yielding either an easily workable dough, or a bread of light and open texture. From opposite causes, therefore, the highly nitrogenous wheats, as they occurred in commerce, were more or less objectionable; and hence it was, that, in practice, the flour containing a small proportion of nitrogenous matter, and a large one of starch, was generally the best, so far as the consumer was concerned. It might be added, as the result of the observation of dietaries on the large scale, that in practice the labouring classes, under the idea of improving their diet, generally first added to their bread, fatty matters of some kind, which still further diminished the relative proportion of the nitrogenous to the respiratory constituents of their food. The addition of bacon would be an admitted improvement upon a purely bread diet for a working man, for when it was considered that a given weight of the fat of the bacon, had about twice and a half the respiratory capacity of the starch of the bread, it would be easily seen how much the proportion of the nitrogen in the food would soon be diminished by the employment of the bacon. In the evidence which the statistics of food afforded, we had therefore, additional reasons for the conclusion, that a comparatively high percentage of nitrogen in flour and bread was by no means a safe test of their food value. He would only add, in reference to the discrepancy which there appeared between the average amounts of water found in bread, by Dr. Odling on the one hand, and Mr. Lawes and himself on the other, that the different modes of operating sufficiently accounted for the different results obtained. Dr. Odling's determinations were made upon the crumb or inner portion only of the loaf, which contained a larger proportion of water than the whole loaf. Their own determinations, however, were made upon entire loaves, in the condition, therefore, in which the bread in the bulk was sold by the baker and eaten by the consumer.

Mr. Dugald Campbell regretted that the lateness of the hour would not allow him to go into a full discussion of the paper, but, as a chemist, who had bestowed considerable attention upon the adulteration of substances generally, and substances of an alimentary nature particularly, he must say that the statements commonly put forth as regarded the use of alum in bread-making were, as the author of the paper had stated, very much exaggerated, and alarming to a degree truly unnecessary. He for one did not think that a small quantity of alum put into bread before baking it, so as to make it more pleasing to the eye, or for any other object, was calculated to be deleterious. He was not prepared to say that a large quantity of alum put into dough might not cause it, when consumed as bread, to be injurious, but he was prepared to say that such a quantity as would do an injury would render the bread unsaleable. He (Mr. Campbell) congratulated the meeting that the "anti-alum-in-bread" gentlemen had argued their case that evening in a milder form than generally, for usually he had heard them assert that they had found crystals of alum of the size of peas in bread. Now, he would ask how could this be unless alum were put into the bread after it came out of the oven for the purpose of deception, for the action of the oven upon dough with alum was entirely to decompose it, and the

alum could no longer be found in the bread or extracted from it as such. The fact was the alum was decomposed, the alumina being found in combination with the phosphoric acid as an insoluble phosphate of alumina, and it was by getting out this insoluble phosphate of alumina, and by the estimation of the alumina in it, that the amount of alum which had been used in the manufacture of the bread could be calculated. It was a much more difficult thing to do this correctly than persons generally imagined, and he (Mr. Campbell) agreed with the author of the paper that the process he had detailed as generally adopted was of no value, and by it alumina (that is what was supposed alumina by ignorant persons) was sure to be found in the bread, although it was known to have had no alum added. They had heard from a gentleman who had been extremely active about alum in bread, that he did not use this process, but a modification of it. He had detailed that modification, and he (Mr. Campbell) asserted that, even adopting that modification, he could not fail to get incorrect results, and that he could not get alumina alone as he declared, and, moreover, that he might get what was supposed to be alumina when no alum had been used in making the bread. They had heard that in every instance where that gentleman gave testimony that the bakers had put alum in their bread, they (the bakers) had confessed to having done so. Now, by mere accident, he (Mr. Campbell) happened to be in the court at Uxbridge where a prosecution of bakers was going on, and the chemical evidence was given by this very gentleman; he regretted to state he could not agree with him as to the perfect harmony of the bakers in the confession of their guilt. A most respectable and long-established baker of the place denied emphatically that there was alum put into his bread, and he brought evidence to prove that he did not use it; but the chemical witnesses, after this denial, although admitting that the quantity was in this instance extremely small, maintained that alum had been added, upon which evidence the man was fined, and left the court still protesting his innocence. He (Mr. Campbell) urged upon the meeting the necessity of receiving, with no moderate degree of caution, statements, upon chemical subjects, too often promulgated by medical men whose chemical experience was limited. For instance, lately they had had papers in journals, and letters in the *Times* and elsewhere, asserting that to live in rooms papered with green papers, was to subject ourselves to a slow poison, for the green of these papers contained arsenic, and arsenical fumes were continually being given off from it. He (Mr. Campbell) had been called upon professionally three times within the last six months by private individuals, who had become alarmed by their medical men, to investigate this subject, and he, in every instance, found that there was no occasion for any alarm whatever; there were no arsenical fumes given off even at a temperature of 140 degrees.

Mr. Alfred Smee would call the attention of Dr. Odling to one fact which he had omitted to notice; that was the influence of the process of cooking on the bread. A very important question was, how the bread should be baked. It was to be considered whether, by longer exposure to the heat of the oven the starch would not be rendered more soluble in the stomach. The outer crust of a loaf was more digestible than the interior, and he thought this point had not received sufficient attention. Having the care of a large institution, he had never been able to satisfy himself as to alum in bread having produced any specific effect. He was not prepared to deny that it might be so. The strong fact mentioned by Mr. Pittard should not be lost sight of—that alumina did not enter into the composition of any organic bodies. This fact would lead to the supposition that any small quantities of that substance taken into the system were excreted, and not absorbed. He believed no chemist had hitherto been able to find alumina in any part of the animal organisation, and the Germans had especially directed their researches in this direction.

Dr. Normandy entered into explanations in support of the accuracy of the analysis he had previously described.

Mr. T. K. Callard said, he, in common with many others engaged in the bread trade of London, was very anxious that the use of alum should be done away with in its manufacture. He did not deny that alum was extensively used, although many bakers did not employ it. They would be glad if scientific men would investigate the matter, and discover some less objectionable substance. Dr. Snow had mentioned a quantity of alum as having been found in bread that he (Mr. Callard) could not suppose to be possible. Such bread could not possibly be eaten, and he thought there must be some mistake as to the quantity. In the manufacture of bread, common salt was always used. Dr. Hassall had analysed salt, and all the ingredients for making bread, in order that he might see whether the alum was contained in the materials before they came into the bakers' hands, and the result was that he found alumina in the salt, and if that was the case, there would scarcely be a loaf of bread without the presence of this substance. It was therefore certain that before evidence could be given that a loaf was adulterated with alum, the chemist ought to be in a condition to state that he found more of this substance in it than could be due to the materials employed.

Dr. Odling said that the question of the use of alum in bread involved two considerations, namely, whether or not it was fraudulent, and whether or not it was injurious. He considered that it was not fraudulent. The public demand in everything was for a good article at a low price, and manufacturers were justified in competing to supply that demand. There was a competition for price and a competition for quality, and the two balanced one another. Once upon a time a glue maker first introduced sulphate of zinc into his glue and size, whereby he was able to produce as good and durable glue and size as his neighbour obtained from higher priced materials. It was true he did not issue placards "size with white vitriol in it," but by means of white vitriol he effected a real improvement in the manufacture, and the public were eventually benefited by obtaining as good an article as previously at a lower cost. Now that alum improved the quality of bread made from inferior flour was indubitable, and admitting for the moment that it was not injurious to health, he considered that a baker was perfectly justified in using it, inasmuch as it enabled him to meet a popular demand, by furnishing an approved loaf at a low price. But he admitted, most fully, that if it should be proved that alum in bread was prejudicial to health, it must, at whatever cost, be dispensed with. But he contended that the use of small quantities of alum in bread had not been shown to be injurious. All arguments founded on the effects of alum *per se* were fallacious, inasmuch as it had been clearly proved by the investigations, first of Mr. L. Thomson, and then of several other chemists, that in bread alum no longer existed as alum, but underwent a most complete decomposition. Arguments founded on observation might be reliable, if different observers agreed. But one said it caused rickets; another, consumption; a third, constipation; a fourth, gastro-enteritis; and a fifth could not perceive any effect whatever. Now, in all cases of chronic poisoning, even by the most minute doses, whether of arsenic, lead, mercury, copper, or silver, &c., the symptoms, though not of an obtrusive character, were so characteristic that all observers recognised the same evils and ascribed them to the same cause. He admitted that alum might occasionally be present in such quantities as to do harm, but he contended that the prevalent notions on the subject were founded on prejudice and assumption, not upon dispassionate proof. He would reply *seriatim* to some of the remarks that had been offered. Dr. Normandy had described a process for the detection of alum, or rather alumina, and, although he could scarcely doubt in his own mind that the results Dr. Normandy had ob-

tained by that process, were really due to alumina, still he did not consider that they amounted to positive proof, and for his part, he should be sorry to go into a Court of Law and say upon oath that such results could not possibly have arisen from any other substance than alumina, or from any combination of substances. He considered, with Mr. Malone, that the final precipitate produced should be subjected to further examination. Moreover, Dr. Normandy must remember that even the process he described was an improvement upon M. Kuhlmann's. It was not the process described in books, an exact pursuance of which would frequently lead to the inference that wheat grain and wheat straw were frequently with alum. But he would also say that Dr. Normandy had described one process to the Society that evening, and another to the Parliamentary Committee not three years ago, which last-mentioned process Dr. Normandy now evidently knew to be utterly fallacious. He (Dr. Odling) still contended, and he would repeat it even more forcibly, that on the subject of alum in bread, there had been an enormous amount of loose and most discreditable chemistry given to the world, and he knew that many bakers had protested, as strongly as men could protest, against the pseudo-chemistry to which they had been exposed. Dr. Normandy had suggested that in the stomach the alumina and sulphuric acid and potash might reunite to form alum. But where was the proof? He (Dr. Odling) had caused a powerful and sure emetic, consisting of thirty grains of sulphate of zinc, to be mixed in a small bread-roll, whereby it became decomposed. Now the person who ate this roll, and he (Dr. Odling) saw it eaten, did not experience the slighest uneasiness of any kind. In this case the sulphuric acid and zinc certainly did not re-unite to form white vitriol! He admitted that M. Mège Mouries laid more stress upon the action of cerealin upon gluten as a cause of the brown colour of bread, than upon its action on starch. But he (Dr. Odling) considered that the conversion of starch into dextrine would of itself account for the browning. He objected to Dr. Snow's results, inasmuch as it was quite impossible for an eatable 4 lb. loaf, yielding only 1.17 per cent. of ash, to contain $1\frac{1}{2}$ ounces of alum. Dr. Snow considered that alum in bread did not act positively as a poison, but simply by abstracting the nutritive substance, phosphate of lime or phosphoric acid. But alum did not remove any phosphoric acid whatever; and the phosphate of alumina really produced was soluble even in very dilute acids. Mr. Pittard's experience, that biscuit or baked flour was preferable to bread for feeding infants, had nothing to do with the question of alum. Inferior bread, without any alum, was very apt to turn sour and disagree. Mr. Varley's observation, that alum, added to imperfectly boiled paste, prevented the liquefaction of the starch when kept, was quite in accordance with his (Dr. Odling's) views. He considered the points raised by Mr. Malone and Mr. Smee of much importance. It might turn out that the maintenance of the integrity of the starch in bread was disadvantageous to its digestibility. In the crust of bread the starch always underwent considerable conversion. But at present the demand undoubtedly was for a white, crumbly, dry loaf.

The Chairman said they had derived much profit and instruction from the valuable paper of Dr. Odling and the discussion which followed upon it. At that late hour he would not trouble the meeting with any remarks of his own, but it was evident in the first place that the detection of alum in bread was a matter of no ordinary difficulty. The detection of alumina with organic matters and substances which contained phosphoric acid was an investigation requiring great nicety. Still there could be no doubt that alum was employed by bakers, and its presence had been indubitably detected in bread sold by them. On the other hand he thought it was not clear whether a small proportion of alum in bread was really injurious or not. Some medical gentlemen strongly condemned it, whilst others appeared not to attach any great importance to it. No doubt when alum was mixed with bread it became decomposed, in baking, and it did not appear to him that it could be reconstituted in the system. He was sure they would all agree with him, when he proposed a vote of thanks to Dr. Odling for his paper, which must have cost him a great deal of time and trouble to prepare.

A vote of thanks was passed to Dr. Odling.

The Secretary announced that on Wednesday evening next, the 14th inst., a Paper by Mr. J. MacGregor, "On the Paddle Wheel and Screw Propeller from the Earliest Times," would be read. On this evening Mr. J. Scott Russell, F.R.S., Vice-President of the Society, will preside.

THE LATE MR. HERBERT MINTON.*

A very large circle of his friends in all classes of society will regret to hear of the death of Mr. Herbert Minton, the most distinguished of English potters, which took place at Torquay, last week. The verdicts of two International Juries had assigned to Mr. Minton an European fame, and the chief place among manufacturers of pottery. Since the days of the first Wedgewood, no one had done so much to advance his art as Mr. Minton. Both at the London and Paris Exhibitions, his works proved that individual enterprise was more than a match for state subsidies. For its extensive variety of manufactures, earthenware, Majolica, Palissy, encaustic tiles, pressed powder mosaics, and porcelain for useful purposes, the single factory at Stoke-upon-Trent surpassed all the imperial manufactories at Sèvres, Meissen, Vienna, and Berlin. Only in decorative porcelain did Sèvres surpass the Stoke works. Mr. Minton inherited his factory from his father, and by his sole ability raised it to the first position among the potteries of Europe. He possessed in a remarkable degree that English pluck which never knows when it is beaten. For many years he battled against the difficulties in making pavement tiles and mosaics by machinery, sinking an immense capital year after year without any return. His perseverance was rewarded at last, and he established the manufacture as a truly national one, and witnessed the paving of the Houses of Parliament and the House of Representatives at Washington, of many of the palaces of Europe, and most of the new churches in England with his tiles. Mr. Minton was one of the first to discuss and promote the international feature of the Exhibition of 1851. He was the chief supporter of the School of Art at Stoke, and he attributed much of his success to the influence of the school. Whilst he was liberal in the extreme, he was a shrewd man of business. One of his earliest acts at the commencement of his prosperity was to build and endow a church at Hartshill, near Stoke; and before he had retired from business, which he did after the Paris Exhibition, he had built both schools and alms-houses, and paved numberless churches throughout the length and breadth of the land. He made it his boast that he spent all his wealth, that he had no money in the funds, and possessed neither land nor shares, and was therefore free of all cares. He used to say that he could spend his money best himself to his own liking, and that he would not trouble his successors. There were but few charities to which he did not unostentatiously subscribe, and very many churches owe much to his bounty. He oftentimes declined to enter Parliament, but was made a Deputy-Lieutenant for Staffordshire, almost against his will. He was married three times, but has left no children. His flourishing business devolves upon his nephews.

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* Communicated by a Member of the Society.

EAST LANCASHIRE UNION OF MECHANICS' AND OTHER INSTITUTIONS.

Examination and Prize Scheme of Male and Female Classes for 1858.

The East Lancashire Union of Mechanics' and other Institutions was formed to encourage and reward men and women in self-education.

The Council of the Union require a certificate, in the following form, from every candidate for examination:—

"The undersigned certify of personal knowledge that is a of sober, honest, and industrious habits, and attentive to the duties of station in life, and that has not been instructed at any higher than an elementary day school, Sunday school, evening class, Mechanics' or other Institution."

Any candidate who may bring this certificate, signed by his employer, or minister, or by the directors or president of his Institution or Evening School, will be admitted, after one month's notice, to the annual examination as a candidate for the certificates and prizes of the East Lancashire Union.

Before receiving any Institution or Evening Class into Union, so as to admit a member of its Committee to the Council of the Union, and to permit such Institution or Class to have the aid of the local and organising masters about to be appointed, the Council must be satisfied as to the character and efficiency of such Institution or Evening Class.

But the intention of the Council is to encourage and reward such persons, supported by manual labour, within the Union, as are making efforts for self-education, whether in evening schools, mutual instruction societies, or Mechanics' and other Institutions, or by their own solitary or partially-aided studies, irrespective of their connection with any Evening Class or Institution in Union, and they will require no other qualification for examination than the above-described certificate and notice.

The scheme for the Examination and prizes for the year 1857-8 will define to what candidates certificates will be granted. *Prizes* are open to competition, by exercises in the *English language and one additional subject.*

On each subject, in each class, candidates may take a rank of *competency*, *merit*, and of *highest merit*.

In each class there will be the following distinctions as to subjects:—

A.—*Exercises in English Language.*—First, second, and third class "English language certificates" will be granted to all who obtain marks of competency. The degree of merit will be carefully defined in the certificate.

B.—Any candidate who may obtain marks of *merit* in one subject, in addition to marks of *competency* or *merit* on the English language, will receive a book prize in addition to the certificate.

These certificates will be distinguished as *upper English language certificates* of the first, second, and third class.

C.—The candidates who obtain the required marks will obtain the *money prizes* and prize certificates.

The money prizes may, however, be received in books stamped with the arms of the East Lancashire Union, and an appropriate inscription if preferred.

To render these arrangements clear, the Council set forth in detail the three divisions of their requirements for *English language certificates*, *upper English language certificates* and *book rewards*, and for *money prizes with prize certificates.*

Third Class.

In the third class the Council require such elementary knowledge as is necessary in the common arts of life, and most important as a means of progress in self-education.

The second section of the third class will comprise:—1. English reading. 2. Writing from dictation with correct punctuation and spelling. A competent knowledge will be denoted by twenty marks on each subject. Thirty marks will denote merit, and sixty the highest merit. Any candidate gaining these marks of *competency* or *merit* will obtain a certificate for English language in the second section of the third class.

The *other subjects* in the second section will be:—(1) Arithmetic, as far as simple proportion, and (2) the geography of England, for each of which thirty marks will denote competency; forty, merit; and ninety, the highest merit. Any candidate obtaining marks of competency or merit in the English language, and marks of merit on one other subject, will obtain a book, in addition to his English language certificate, and a more valuable volume for marks of merit on an additional subject.

The first section of the third class will comprise—(1) Reading aloud with good articulation and expression. (2) Writing from dictation, with correct punctuation and spelling. (3) Writing from memory a simple narrative, read aloud twice by the candidates. (4) Writing a letter on some probable domestic occurrence, selected by the Examiner. It is not intended, in this class, to test the knowledge of spelling and grammar, otherwise than by these exercises.

Competence will be denoted by twenty marks; thirty will denote *merit;* and forty-five the highest merit.

A candidate gaining marks of competency in these exercises will obtain a *Certificate for English language* in the first section of the third class.

The other subjects in the first section of the third class will be (1) Arithmetic in the rules which commonly precede decimal fractions. (2) Geography of Great Britain, limited to the mountain chains, water-sheds and river drainage, and the situation of the coal-fields; all of which will be considered as affecting the sites of the chief ports, towns, and manufactures.

Thirty marks will denote competency; forty merit; and eighty-five the highest merit in geography and arithmetic.

A candidate obtaining marks of competency or merit in the English language, and marks of merit in one other subject, will obtain a book in addition to his English language certificate.

A more valuable volume will be given if marks of merit be obtained in a second additional subject.

The Money Prizes and the Prize Certificates in the Third Class.—Second Section.

The Council will award prizes of one pound to the six best candidates in the second section.

First Section.*

The Council will award prizes of two pounds to the five best candidates in the first section.

Second Class.—English Language Exercises.

Each candidate will be required:—(1) To analyse and parse, in writing, a passage of English. (2) To paraphrase a passage from verse into prose. (3) To repeat with proper expression, fifty lines from Cowper's "*Charity,*" selected by the Examiner. (The whole poem or the first four hundred lines must in that case be committed to memory.)

Competency will be denoted by twenty-five marks; merit by thirty-five, and the highest merit by forty-five.

The remaining subjects in the second class will be:—(4). To work decimal fractions, and the usual rules in the mensuration of plane surfaces and solids. (5). To answer, in writing, questions on the geography of the British Islands and Empire. (6). To answer questions on the simple mechanical powers (lever, wheel and axis, pulley, wedge, screw).

Competency will be denoted by thirty marks; merit by forty marks; and the highest merit by sixty-five.

A candidate obtaining marks of merit on one subject besides the English Exercises will obtain a volume in addition to his English language Certificate. The highest merit will be denoted by four hundred marks.

The Council will award prizes of three pounds each to the eight best candidates who have marks of merit on each subject, or marks of merit equal to the sum of such marks.

First Class.—English Language Exercises.

(1). The candidate may write his own thoughts on any of the following subjects, viz.:—

On the best mode of educating a boy born in this country of parents supported by manual labour, or on the best course of self-education for a young man of the working class, after leaving the daily school; or on the comparative cost in money of self-education, and of habits of self-indulgence; or on household economy, as for example, the selection of a house, as respects the healthiness of the site—its drainage—method of warming and ventilation—arrangements for the comfort and morality of the family. Also on the best modes of preventing the spread of a contagious disease in a household, and of disinfecting a house which has been visited by such a malady.

(2). He will be required to analyse and parse a passage from one of the English poets, and to explain its construction fully in writing.

Competency will be denoted by forty marks; merit by sixty, and the highest merit by eighty.

The remaining subjects of examination in the first class may be any of the following:—four of them at least must be successfully worked to entitle a candidate to a Money Prize.

Any candidate may be examined orally and by written questions on Paley's Natural Theology; the History of England, since the Accession of Elizabeth; in Algebra or in Tate's Mechanics; the History, Theory, and Construction of the Steam Engine; Chemistry, especially in its application to manufactures and agriculture.

Competency will be denoted by thirty marks; merit by fifty; and the highest merit by eighty-five.

A candidate obtaining marks of merit on any one of these subjects, in addition to marks of competency on the English Exercises, will obtain a volume in addition to his English Language certificate.

The highest merit will be denoted by five hundred marks.

The Council will award prizes of five pounds each to the six candidates who having marks of merit in each subject of the English exercises, and on four other subjects, or marks of merit equal to the sum of such marks, have also the highest number of marks among the competitors.

Any candidate may be examined in mathematics, or in any department of natural science not named, by giving notice to the Examiners, one month before the examination, of the nature and extent of his acquirements, in order that an examination paper may be prepared to test his knowledge. He will have credit for any marks thus gained. The three degrees of competency, merit, and the highest merit, will be denoted by thirty, fifty, and eighty-five marks respectively.

No candidate will be admitted to examination in the class in which he obtained a money prize in a former year. If unsuccessful, he may enter that or a higher class—if successful, he can compete in future only in a higher class.

The Council being also desirous to encourage Evening Schools for females, and Female Evening Classes in connection with the several Institutions, propose that the foregoing scheme, so far as it relates to the English exercises, shall be applicable to such classes with the following special adaptations:—

The Council will grant to females, *Certificates* for marks of *competency in three classes of English Exercises—and Book Prizes* for *marks of merit.*

They will also, to all females who obtain marks of merit in any of the three classes of English exercises, award prizes of greater value in books or money, provided marks of merit be obtained in an exercise in one of the following subjects.

Third Class.—Females.

Second Section.—Arithmetic as far as compound division.

First Section.—Arithmetic as far as Practice. The candidate will also answer questions as to the best application of the earnings of a working man's family (the ages of each member of which will be given), for food under several heads, for clothing, for the Sick club or Life Assurance Society, or Savings Bank, stating how much of the income should be spent on each.

Second Class.—Females.

In this class the female candidates who compete for the higher prizes will answer questions on the following subjects.

Food.—The best materials for the meals of a working man—the prices of each article of food—the amount of nourishment which it contains—and the best mode of cooking it.

Clothes.—The most durable, warm, and cheap clothing for women and children within the means of a family supported by manual labour. How to cut out, make, mend, and preserve clothes, in a neat and wholesome condition; also exercises in household account keeping.

First Class.—Females.

Will show books of household accounts neatly kept as exercises in their classes.

They will answer, in writing, questions on the prices of food, clothing, furniture, and other objects of expenditure in a labourer's family, and will work calculations of the cost.

They will write their thoughts on one of the following subjects.

Household Arrangements.—How to regulate and improve the ventilation of a cottage by simple and cheap means. How to keep floors, bedding, furniture, walls and utensils in a perfectly wholesome condition.

Management of Children.—In Health.—What precautions to take against colds, coughs, chilblains: against contagious diseases—and in their daily regimen and habits. *In Sickness.*—How to keep a sick room—to prepare food for various infantile complaints—for a general feverish disorder—to give simple medicines for common wants—to dress a burn or scald: a bruise or a cut.

What "*nostrums*" and ill practices to avoid, in bringing up and nursing children.

Moral Arrangements.—As regards cleanliness, obedience, truthfulness, purity of language, reverence, religious duties.

Sickness in Adults.—How to prepare whey—beef-tea—mutton-broth—barley-water—lemonade—effervescing draughts—poultices. How to bandage a leg or arm—to stop a sudden bleeding—to manage a "fainting fit"—and to soothe and comfort the sick and dying.

In order to enable young women to gain a competent knowledge of domestic sanitary arrangements and management of children and the sick, the Council of the East Lancashire Union would suggest that no more laudable service could be rendered to females in attendance on the Evening Classes in the Union than a series of familiar lessons on these subjects from practitioners of medicine.

Such lessons would prevent much suffering and save many lives.

Other lessons on household economy might be given in the form of conversation, by ladies, to the Sewing Classes.

The Council strongly urge that Female Classes should be organized for this form of instruction throughout the East Lancashire Union.

The Council will require specimens of needle-work, cutting out clothes, and making ordinary linen and cotton garments. They will request the aid of experienced ladies in determining the merit of this work.

The Council suggest that the class-rooms of the several Institutions should be neatly fitted up with groups of parallel desks and benches suitable for the instruction of classes of 18 or 21 in three rows of six or seven pupils each. Such groups of desks and benches facilitate that collective teaching which it will be the duty of the organizing masters to introduce, where it does not at present exist. The classes should also be provided with black-boards, easels, maps, class-lesson books, and slates.

The Council recommend the directors of the several Institutions to take steps to have the instruction in their evening classes regulated, so as to prepare their pupils for examination, especially by accustoming them to written exercises. They also suggest that, in the month of March and April preliminary examinations should be held in each Institution of all pupils desirous to become candidates; and each pupil should, after such examination, be advised as to the class in which he should enter his name.

The examinations will be conducted by one or more impartial persons selected by the Council.

It will be partly oral, but chiefly by means of written answers to printed questions, which will be put before each candidate.

The candidates will answer these questions without any assistance from books or from each other, and write them in the presence of the examiners. When the answers are finished, they will be sealed up, and sent to some gentleman unknown to the parties, who will assign marks to each paper. As soon as this is done, the successful candidates will be declared.

The Prizes will be distributed publicly.

The chief employers of labour in the district have declared, that they will attach much value to the certificates granted by the Council as proofs of meritorious exertion, correct life, and mental capacity, in giving employment or promotion. It is hoped that they will acquire a distinct mercantile value, and promote the commercial advancement of successful candidates.

The Council have purposely not specified skill in art in the list of subjects of examination, because they propose to award separate prizes for such skill.

The prizes will be divided as follows :—

1. Drawing of form from Models and Diagrams, on the method published by Mr. Butler Williams.
2. Map and Plan Drawing, for Surveyors of Land, &c.
3. Mechanical Drawings, including Machinery, Tools, and Working Drawings, of Buildings, Carpenters' Work, Masons' Work, Excavations, &c.
4. Architectural Drawings.
5. Industrial designs for all the trades of the District.
6. Drawing of the Human Figure.

Special arrangements will be made for the examination of the progress of pupils in the several Schools of Design, and for testing their ability; and a prize will be awarded under each of the above heads.

SOUTH KENSINGTON MUSEUM.

During the week ending 3rd April, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 3,713; on Monday and Tuesday, free evenings, 3,449. On the two Students' days (admission to the public 6d.), 409; one Students' evening, Wednesday, 276. Total 7,897.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 20th and 22nd March, 1858.

SECOND SESSION, 1857.

77 (C). Poor Rates and Pauperism—Return (C).

Delivered on 23rd March, 1858.

83. Public Offices (Downing-street)—Copy of Correspondence.
122. Duchy of Lancaster—Account.
130. Income Tax Collectors (Tynemouth)—Return.
141. Railway and Canal Bills—1st Report from the General Committee.

Delivered on 24th March, 1858.

120. Poor Law Medical Relief (Scotland)—Returns.
127. Sandhurst College—Return.
128. Bands, &c.—Return.
133. Hops—Return.
139. Shipping—Return.

Delivered on 25th March, 1858.

123. Printed Papers—Return.
143. Civil Services—Estimate to Votes "on Account."
146. Committee of Selection—Fifth Report.
147. Army (Educational and Scientific Branches)—Supplementary Estimate.
121. Oxford University—Copies of two Ordinances.
117. Railway and Canal Bills (70. Athenry and Tuam Railway; 71. Ballymena, Ballymoney, Coleraine, and Portrush Junction Railway; 72. Banbridge, Lisburn, and Belfast Railway; 73. Belfast and County Down Railway; 74. Dublin and Meath Railway; 75. Great Northern and Western of Ireland Railway; 76. Limerick and Castle Connell Railway; Leitrim Railway and Lough Allen Pier; 77. Waterford and Kilkenny Railway (Capital); 78. Waterford and Kilkenny Railway (Power of Purchase, &c.)—Board of Trade Reports.
38. Bills—Customs Duties.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Architects, 8. Mr. C. R. Cockerell, "Some Remarks on the old Vatican Basilica, and its conformity to the Christian rules of Building known to us, of subsequent date."
Geographical, 8½. I. Dr. H. Rink, "On the Supposed Discovery of the North Coast of Greenland and an open Polar Sea, &c., by Dr. Elisha Kent Kane, U.S. Navy." II. Mr. Wm. Lockhart, "On the importance of Opening the Navigation of the Yang-tse-kiang, and the changes that have lately taken place in the bed of the Yellow River, &c."

TUES.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Syro Egyptian, 7½. Mr. Thos. Sopwith, "On the Progress of Modern Improvements in Egypt."
Civil Engineers, 8. Mr. G. Robertson, "On the Theory and Practice of Hydraulic Mortar."
Med. and Chirurg., 8½.
Zoological, 9.

WED. ......United Service Inst., 3. Mr. John Craufurd, "On India, as connected with a Native Army."
Literary Fund, 3.
Archæological Asso., 4. Anniversary.
Society of Arts, 8. Mr. J. MacGregor, "On the Paddle Wheel and Screw Propeller, from the Earliest Times."
Chemical, 8. Dr. Odling, "On Atoms, Molecules, and Equivalents."
Geological, 8.
Graphic, 8.

THURS. ...Royal Inst., 3. Prof. Tyndall, "On Heat."
Antiquaries, 8.
Linnean, 8.
Royal, 8½.

FRI..........United Service Inst., 3. Capt. Tyler, "On the Effect of the Modern Rifle upon Siege Operations, and the means required for counteracting it."
Royal Inst., 8½. Mr. Robert Godwin Austen, "On the Conditions which determine the probability of Coal beneath the South-Eastern parts of England."

SAT..........Royal Inst., 3. Mr. Edwin Lankester, "On the Vegetable Kingdom in its relations to the life of Man."
Medical, 8.
Asiatic, 8½. Mr. Cyril C. Graham, "On the Ethnology of Syria and Palestine, from the earliest times down to the present."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 2, 1858.]

Dated 1st Dec., 1857.

2982. J. Young, Glasgow—Imp. in measuring liquids.

Dated 16th Feb., 1858.

292. R. Anderson and J. J. Prescott, Duke street, Liverpool—Imp. in lubricators.

Dated 18th Feb., 1858.

306. J. Piddington, 77, Montagne de la Cour, Brussels—Imp. in the manufacture of fuel, commonly called artificial or patent fuel.

Dated 20th Feb., 1858.

328. T. Metcalf, Newton Heath, Manchester—Imp. in the purification of crude tar oil, rendering the same suitable for lubricating machinery and other similar purposes.

Dated 3rd March, 1858.

420. J. Gowing, Poplar, and H. Bull, Greenwich—Imp. in apparatus for preventing smoke, applicable to tubular boilers.

Dated 9th March, 1858.

478. F. C. Warlich, Hope cottage, Gloucester-place, Kentish-town—Imp. in apparatus for generating steam.

Dated 11th March, 1858.

490. A. J. Holdsworth, Leeds—A safety railway oral communication.
492. G. T. Bousfield, Loughborough-park, Brixton—Imp. in knitting machines. (A com.)
494. J. D. Leathart, Newcastle-on-Tyne—Imp. in furnaces.

Dated 12th March, 1858.

496. A. Porecky, 7, York-street North, Hackney-road—Imp. in the manufacture of the frames of umbrellas and parasols.
500. T. Thompson, Radbourne, Derby—Imp. in vats for cheese making.
502. W. Pearson, Brierley-hill, Staffordshire—A new or improved washing machine.
504. J. Wright, 10, Alfred-place, Newington-causeway, Southwark—Imp. in the treatment of machine-made malleable iron nails. (A com.)
506. A. V. Newton, 66, Chancery-lane—A new combination of instruments for extracting teeth. (A com.)

Dated 13th March, 1858.

510. C. Tilliere, Brussels—Certain imp. in machinery for forging, planing, and stamping cold or heated metals.
512. G. Pigott, Nottingham—Imp. in Jacquard machinery for figuring lace and other fabrics.
516. A. V. Newton, 66, Chancery-lane—Improved machinery for making horse shoes. (A com.)

Dated 15th March, 1858.

518. J. C. Martin, Fern cottage, Charlewood-road, Putney—An improved plastic compound for the manufacture of moulded articles, to be used as a substitute for wood carvings, and for many of the purposes to which papier maché is applicable.
522. R. A. Brooman, 166, Fleet-street—Imp. in sewing machines. (A com.)
528. J. Hamilton, jun., Liverpool—Imp. in apparatus for propelling vessels.
530. J. F. Empson, junr., Birmingham—An imp. or imps. in ornamenting certain kinds of buttons.

Dated 16th March, 1858.

532. D. Gallafent, Stepney Causeway—Certain imps. in machinery or apparatus for cooling liquids and condensing vapours.
534. M. Henry, 77, Fleet-street—Imp. in the manufacture or production of artificial marble, frescoes, and decorative, ornamental, and artistic surfaces, objects, and works. (A com.)
536. J. Lawson, Hope Foundry, Leeds—Imp. in machinery used in spinning flax and other fibrous substances.

Dated 17th March, 1858.

538. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—Imp. in machines for cutting and harvesting grain and grass crops. (A com.)
539. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the treatment of horn, and in the application of it when so treated as a substitute for whalebone in the manufacture of umbrellas, parasols, and similar objects. (A com.)
540. D. Nicoll, 114, Regent-street—Imp. in machinery for cutting out military, naval, and police uniforms, and other clothing.
541. W. Todd and J. Todd, Heywood, Lancashire—Certain imp. in power looms for weaving, and in shuttles to be employed therein.
543. J. Gooderham, John's cottage, Mathias-street, Kingsland—Imp. in shoemakers' wax.
544. W. C. Beatson, Masbro', Yorkshire—Imp. in apparatus to be used in the manufacture of glass bottles.
545. T. C. Hine, Nottingham—Imp. in lighting and ventilating by gas.
546. T. Evans, Hanover-street, River-terrace, Islington—Imp. applicable to the manufacture of parasols.
547. R. A. Brooman, 166, Fleet-street—Imp. in the construction of boxes or cases for trees, flowers, and other horticultural and floricultural purposes. (A com.)
548. W. Ward, Smethwick—New or improved machinery for the manufacture of nails, spikes, bolts, rivets, screw blanks, and nuts.
549. J. Oxley, Beverley, Yorkshire—An elastic cushion or fitting piece for windows, blinds, shutters, and doors, which is also applicable for other purposes.

Dated 18th March, 1858.

551. R. Glanville, Bermondsey—Imp. in condensing steam engines.
553. J. Webster, Birmingham—Certain new or improved metallic alloys.
555. A. Dunlop and A. Stark, Moor Park Mill, Renfrew, N.B.—Imp. in dressing or sifting flour and meal or reduced grain.
557. R. A. Brooman, 166, Fleet-street—An improved knee cap. (A com.)
559. R. Townend and W. Townend, Bradford—Imp. in piston-valve musical instruments.
561. A. A. Croll, Coleman-street—Imp. in the manufacture of parts of dry gas meters.

Dated 19th March, 1858.

563. P. F. Aerts, Brussels—Imp. in the construction of railway rolling stock, and in the lubrication thereof, and other moving parts of machinery.
565. G. Scott, Manchester—Imp. in generating elastic fluids, and in apparatus for that purpose.
567. W. H. Rhodes, Oldham—Imp. in speed indicators and calculators.
569. T. C. Medwin, 10, Clayton-place, Kennington-road—Certain imp. in the construction of water guages for steam boilers.
571. D. Evans, 15, Railway-terrace, New-town, Stratford—An imp. in apparatus for supplying air in streams to furnaces.
573. J. Young, Knaresboro'—Imp. in chronometers, clocks, and watches.

Dated 20th March, 1858.

575. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in the piercing of tunnels. (A com.)
579. L. Cowell, Adelphi—Imp. in machinery or apparatus for teaching the art of swimming.
581. R. Mills, Bury—Imp. in washing machines.
583. J. Biggs and W. Biggs, Leicester—An imp. in the manufacture of polkas when looped or elastic fabrics are used.
585. J. Le Franc, 58, Aldersgate-street—Imp. in pressure guages. (A com.)
587. W. E. Newton, 66, Chancery-lane—An improved mode of treating and combining various combustible matters or substances for the production of artificial fuel. (A com.)

Inventions with Complete Specifications Filed.

577. D. Harris, Massachusetts, U.S.—A new and useful or improved sewing machine. (20th March, 1858.)
648. R. Williams, 8, Bishop's road, Victoria-park—An imp. for manufacturing a soap for cleansing, bleaching, and purifying purposes.—27th March, 1858.

WEEKLY LIST OF PATENTS SEALED.

April 1st.

2523. J. M. Napier.
2527. A. Illingworth and H. Illingworth.
2529. J. S. Willway.
2537. W. Riley and T. Riley.
2545. J. Rubery.
2548. R. Atkinson.
2555. E. Cavendy.
2557. R. H. Hughes.
2560. R. A. Brooman.
2564. W. Knapton.
2566. J. Warburton.
2569. W. Gossage.
2577. W. G. Craig.
2585. G. Scott.
2597. C. N. Leroy.
2650. W. Holroyd and S. Smith.
2665. J. J. Sieber.
2693. A. H. C. Chiandi.
2749. D. Allison and J. Livingston.
2803. C. Clay.
3113. J. M. Napier.
110. P. Wilson, S. Northall, and T. James.
213. A. Crichton and M. Whitehill.

April 6th.

2563. G. T. Robinson.
2574. T. Grubb.
2600. W. H. Myers.
2628. F. H. Holmes.
2635. W. A. Rooke.
2649. J. Wright.
3139. A. C. Kennard.
166. J. Wotherspoon.
192. J. Gray.
252. J. Chatterton.

Patents on which the Stamp Duty of £50 has been Paid.

March 27th.

418. A. E. L. Bellford.

March 29th.

708. W. Swain.
710. G. H. Babcock and A. M. Babcock.
752. C. Nickels and J. Hobson.

March 30th.

231. R. A. Brooman.

March 31st.

1865. J. H. Tuck.

April 1st.

729. F. Phillips.
736. W. Lund and W. E. Hipkins.
737. F. T. Botta.
748. H. R. Fanshawe and J. A. Fanshawe.
755. L. A. M. Mouchel.

April 3rd.

742. H. Powers.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4069	March 25.	Improved Solid Rule Joint	Griffiths and Hughes	Birmingham.
4070	,, 25.	The Smokers' Sweetheart	A. Smart and J. Howland	Fenchurch street, City.
4071	,, 26.	Reading Stand	Rev. A. W. Noel	Cropredy, Oxon.
4072	,, 27.	Prismatic Reflector for Ceiling Gas Lights	W. Wilson	King-street, Manchester.
4073	April 6.	Tag or Fastener	M. Lyons	Suffolk, Birmingham.

Journal of the Society of Arts.

FRIDAY, APRIL 16, 1858.

EXHIBITION IN 1861.

At a Special Meeting of the Council, held on Wednesday last, the 14th inst., the following resolutions were passed:—

The Council of the Society of Arts, bearing in mind the part which the Society took in originating the Great Exhibition of 1851, have considered it to be their duty carefully to examine various suggestions for holding an Exhibition in 1861, which have been submitted to them, and have resolved:—

1. That the institution of Decennial Exhibitions in London, for the purpose of showing the progress made in Industry and Art during each period of ten years, would tend greatly to the "Encouragement of Arts, Manufactures, and Commerce."

2. That the first of these exhibitions ought not to be a repetition of the Exhibition of 1851, which must be considered an exceptional event, but should be an Exhibition of works selected for excellence, illustrating especially the progress of Industry and Art, and arranged according to classes, and not countries; and that it should comprehend Music and also Painting, which was excluded in 1851.

3. That Foreigners should be invited to exhibit on the same conditions as British Exhibitors.

4. That the Council will proceed to consider how the foregoing resolutions can be best carried into effect.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday, the 24th April, at the Society's House, the card for which will admit the member only; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit the member and two friends, ladies or gentlemen. The cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

Members of Institutions in Union who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 5th instant.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members, by ticket, or written order bearing their signature, may admit any number of persons. The number of visitors up to yesterday, the 15th inst., was 1,785.

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty Local Boards have been formed. Returns of the Candidates who have passed the Previous Examination have been received up to the 15th inst., as follows:—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	83
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No. 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	17
Halifax	15

Institutions and Local Boards are requested to take notice, that the Returns of the Previous Examinations should be forwarded *immediately* to the Secretary of the Society of Arts.

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

T. D. Acland, Member of Council	£ 5	5
The Rt. Hon. C. B. Adderley, M.P.	5	0
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	£ 2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10

George Moffatt, M.P.	£10 10
Sir Thomas Phillips, Member of Council ...	5 5
William T. Radford	1 1
Charles Ratcliff, Hon. Local Sec. (annual)...	10 10
Joseph Skey, M.D.	1 0
William Tooke, F.R.S., Vice-Pres.	10 10
Arthur Trevelyan	1 0
T. Twining, jun., Vice-Pres.	10 10
Dr. J. Forbes Watson	1 1
G. F. Wilson, F.R.S., Member of Council (third donation)	10 10

GUTTA PERCHA.

The Council have appointed a Committee to direct the institution of a series of experiments on Gutta Percha, and to report from time to time such observations as may appear to elucidate the nature and cause of its decay, the different qualities of the substance, modes of detecting adulteration, or any other points valuable to the manufacturer or to those who use it.

The Council invite the co-operation of the Agricultural Societies in the superintendence of a series of experiments, especially as regards the employment of Gutta Percha in different soils, and for the distribution of liquid manures.

The Committee consists of the following, with power to add to their number:—

*H. Ford Barclay.
The Rev. M. J. Berkeley, M.A., F.L.S.
Dr. Albert J. Bernays, F.C.S., Lecturer on Chemistry, St. Mary's Hospital, London.
*Dugald Campbell, F.C.S.
Latimer Clark, A. Inst. C.E., Engineer to the Electric Telegraph Company.
Arthur Henfrey, F.R.S., Professor of Botany, King's College, London.
*Edward Highton, A. Inst. C.E., F.H.S., Consulting Engineer to the British and Irish Magnetic Telegraph Company.
John Lindley, F.R.S., Professor of Botany, University College, London.
*C. W. Siemens, C.E.
*Professor E. Solly, F.R.S. (Mem. of Council.)
*Sir Walter C. Trevelyan, Bart.

* Members of the Society of Arts.

The Committee have met three times, and with the view of obtaining as much information as possible in reference to the subjects above referred to, they propose to issue the following questions, which will be circulated amongst those most likely to afford the desired information:—

1. Over how long a period does your experience of the use of Gutta Percha extend, and for what purpose was the Gutta Percha employed?
2. Have you found the Gutta Percha so used to change its character, or decay, after a certain period? If so, state the length of this period, and the nature of the change.
3. Have you had the Gutta Percha analysed before and after this change? If so, give the analyses.
4. Can you state what change takes place in Gutta Percha during its apparent drying and contraction, when exposed to the weather?
5. What, in your opinion, is the most effectual method of arresting this change?
6. Have you met with Gutta Percha mixed with any other substance, and, if so, with what substance or substances, and what have been the effects?
7. Have you had any experience of sulphured Gutta Percha, and, if so, state the results?
8. Have you made any experiments as to the tenacity of Gutta Percha? If so, what were the results; and were your experiments made with fresh or old Gutta Percha?
9. Have you found that exposure to light, heat, damp, cold, or any other special influences, alters the character of Gutta Percha?
10. Have you found any substance, such as tar, sea water, common water, &c., to be preservative of Gutta Percha?
11. Have you found that any particular substances have an injurious effect on Gutta Percha, or have you noticed that any insects or animals attack it?
12. Can you suggest any method of joining Gutta Percha superior to that now employed?
13. Do you know any means of rendering Gutta Percha a more perfect non-conductor of electricity?

The Committee are also desirous of obtaining information on the following points, having reference to the sources of supply of Gutta Percha:—

14. Is the Gutta Percha taken from the trees at particular seasons exclusively?
15. If taken at one particular season, does that correspond to the time of the renewal of foliage, of blossoming, or of ripening seed?
16. If taken at different seasons, at which of these seasons is the best quality obtained?
17. Has the age of the tree any influence on the quality of the Gutta Percha?
18. Is there any method practised of procuring Gutta Percha from a tree without cutting it down, and if so, with what results?
19. Are the products of different species of plants known indiscriminately under the name of Gutta Percha?
20. How far do the different qualities of commercial Gutta Percha depend upon any of the last six questions?
21. If Gutta Percha is produced by several trees, what are the scientific or native names of those trees, and which of them is at once productive of the best quality and most calculated for cultivation?
22. What parts of the world, and what kinds of soil and climate, appear to be best adapted for the cultivation of trees producing Gutta Percha?
23. What is the best mode of cultivation, whether by seed, cuttings, &c.?
24. What measures might be adopted with advantage to secure a continual and increasing supply of Gutta Percha?
25. If you have no experience yourself in this subject, do you know of any person who has, and who, by answering the above questions, or some of them, might tend to advance the present inquiry?

The Committee would feel obliged by replies to any of the above questions, as well as suggestions of experiments likely to elucidate the subject, being addressed to the Secretary of the Society of Arts, Adelphi, London, W.C.†

† Any person having portions of decayed or altered Gutta Percha, the causes of the change in which he is able to state, is invited to forward them to the Secretary of the Society of Arts, with their history.

As the labours of the Committee will be considerable, in arranging and tabulating the results of this enquiry, it is particularly requested that answers to any of these questions be written only on *one side* of the paper, and that the *number* of the question answered be given at the head of each reply.

EIGHTEENTH ORDINARY MEETING.

WEDNESDAY, APRIL 14, 1858.

The Eighteenth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 14th inst., J. Scott Russell, Esq., F.R.S., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Adderley, the Right Hon. Charles Bowyer, M.P.
Bowles, Richard Francis
Oxley, John
Shuttleworth, Sir James Kay, Bart.

The following Institution has been taken into Union since the last announcement:—

Wycombe Literary Institute.

The Paper read was—

ON THE PADDLE-WHEEL AND SCREW-PROPELLER, FROM THE EARLIEST TIMES.

BY JOHN MACGREGOR.

The approaching trial, for the first time, and on the grandest scale, of the paddle-wheel and screw-propeller in the same vessel, may well suggest the consideration of these two instruments in the same paper, while they are so different in origin and operation, that it will be best to treat of each of them separately.*

We shall begin with the paddle-wheel as the older method, though the other was first matured, and is now the more popular.

Several modern writers state that the paddle-wheel was used by the ancient Egyptians, but I can find no proper evidence to warrant this assertion.

The wheel of a chariot in an old Egyptian painting of a boat, has often been mistaken for a paddle-wheel, and a precisely similar mistake has been made in describing one of the sculptured slabs from Nineveh, but Sir H. Rawlinson and Dr. Layard assure me, that in their Babylonian researches they have not discovered any indication of the use of machinery for propelling vessels.†

Pancirollus, who wrote in 1587, says he saw an old bas-relief representing an Illyrian galley propelled by three wheels on each side turned by oxen. The same author, and several others, refer to Vitruvius for a notice of the paddle-wheel, but I find, in five editions of Vitruvius, the drawings represent merely a wheel turned by the water, and used as a log to measure the speed.

Again, Claudius Codex is said to have employed paddle-wheels in the invasion of Sicily in the third century before Christ, and some MSS. in the King of France's library (which I have not been able as yet to inspect), are referred to for this statement, but after diligent inquiry, I can find no confirmation of it in any accredited authority. An old work on China contains a sketch of a vessel moved by four paddle-wheels, and used perhaps in the seventh century, but the earliest distinct notice of this means of propulsion appears to be by Robertus Valturius, in A.D. 1472, who gives several woodcuts representing paddle-wheels.

Some months ago, I inspected two letters, written in A.D. 1543, by Blaseo de Garay, and now preserved in the national archives at Simancas, in Spain. These give the particulars of experiments at Malaga and Barcelona, with large vessels propelled by paddle-wheels, turned by 40 men. By many authors, and for a long time, it has been positively affirmed that Blaseo de Garay used a steam-engine for marine propulsion, but, after careful and minute investigations at Simancas, Madrid, and Barcelona, I cannot find one particle of reliable evidence for this assertion.

After the various notices referred to, we find boats propelled by paddle-wheels mentioned by many early writers, such as Julius Scaliger, in 1558, Bourne in 1578, Ramelli in 1588, and Roger Bacon, 1597.

Before we consider the application of the steam-engine to turn paddle-wheels, it is well to notice briefly some of the other agencies employed.

The muscular power of men, of horses, and of other animals, was often used and frequently patented, even to the year 1848, by Miller; and 1856, by Moses. The Marquis of Worcester, in 1661, patented the application of a current, to turn paddlewheels on a vessel which they propelled by winding up a rope.* Papin, in 1690, proposed to work the wheels by gunpowder, exploded under pistons; Conrad (1709) used the force of the wind, Maillard (1733) and Goutaret (1853) applied clockwork, Harriott (1797) used falling water; weights were employed by Tremeere (1801); Congreve (1827) used the capillary attraction of a wheel of sponge or glass plates; Dundonald (1833) applied the oscillations of mercury, and Jacobi (1838) employed an electro-magnet to work the paddle-wheels of a vessel on the Neva. The whole number of English patents relating to marine propulsion is 802, from the earliest, granted to Ramsey in 1618, to those of June, 1857.†

It appears that Denis Papin, in 1690, first proposed to use steam to work paddle-wheels. A rackwork was moved by pistons descending in steam cylinders by atmospheric pressure. Savery, in 1702, scarcely ventured with timidity to suggest the use of his steam-engine for the purpose, but it is asserted in a French work that Papin, in 1707, actually propelled a vessel on the Fulda by Savery's engine.

The first patent relating to a steam-boat is that of Jonathan Hulls, in 1736. He placed a paddle-wheel on beams projecting over the stern, and it was turned by an atmospheric steam-engine, acting in conjunction with a counterpoise weight, upon a system of ropes and grooved wheels.

The Comte d'Auxiron and M. Perrier are stated to have used a paddle-wheel steamboat in 1774, but the notices of these and of other early experiments are very vague, not contemporaneous, or on doubtful au-

* The paddle-wheel propels a vessel in a direction perpendicular to the shaft, while the screw-propeller urges it in a direction parallel to the shaft.

† An old Chinese woodcut, in the late Dr. Morrison's library (at University College Library), has some resemblance to a paddle-wheel, but this also is probably misinterpreted.

* Chabert (1710), Drouet (1722), Pitot (1729), and Boulogne (1729), used a similar plan.

† The information contained in this paper was collected by the writer in compiling, for the Great Seal Patent Office, the "Abridgements of the Specifications" of these patents. Parts I. and II. of this work have been published by the Commissioners of Patents, and the remaining Part will shortly appear. As the authority for every statement is distinctly given in these publications, it will not be necessary to give references here. The following statistics relate to the patents above-mentioned. Patentees resident in the city of London, 83, in the county of Middlesex and city of Westminster, 252; Surrey, 59; Lancashire 46; Kent, 29; Hants 19; Yorkshire, 18; Gloucester, 18; Essex, 11; Sussex, 10; Northumberland, 9; Chester, 9; Worcester 6; Stafford 6; Derby, 5; Nottingham, 5; Durham 5. All the other counties have a less number and ten of them have only one each. Patentees resident in Scotland, 45; Ireland, 20; America, 18; other foreign states 46. Patents "communicated from abroad" 64; with two or more patentees 66. The patentees are described by the following avocations—engineers, 273; gentlemen, 251; tradesmen, 74; naval commanders, 14; medical, 11; shipbuilders, 11; peers, 8; shipowners, 8; mariners, 5; machinists, 5; farmers, 4; architects, 4. A less number to each of 21 other professions. There are two female patentees, and the callings of 160 are not mentioned. 80 of the patents are dated in January, 46 in August, and the other months have intermediate numbers. 305 of these patents are under the new law since 1852, and of these 110 were allowed to become void after 6 months.

thority. Desblancs, in 1782, sent a model to the Conservatoire (still there) of a vessel in which an endless chain of floats is turned by a horizontal steam-engine.

The first notice I can find of a successful trial of the steam-boat recorded by witnesses, is in a notarial certificate, which I lately inspected in Paris. This asserts that in July, 1783, the Comte de Jouffroy caused a vessel of 130 feet in length to be propelled for a quarter of an hour by a steam-engine upon the Saône, near Lyons.*

Experiments conducted about the same time, at Dalswinton, in Scotland, by Patrick Miller, resulted, in 1787, in the successful use of a steam-engine, by Miller, Taylor, and Symington, to propel a vessel by paddle-wheels, which worked one before the other in the centre of the boat.

The engine of this, the first practical steam-vessel, is still preserved by Mr. Bennet Woodcroft, Superintendent of Specifications at the Great Seal Patent Office, and it may now be seen at the Patent Museum in Kensington.

The *Charlotte Dundas* was built on the Clyde canal in 1801. Although Fulton used a steamer on the Seine in 1803, and another in America, *The Clermont*, in 1807, was the first that plied so as to be remunerative in that country. In 1809, the *Fulton the First*, steam-frigate, was launched at New York. Bell built the *Comet* in 1811, at Glasgow, and used it regularly for traffic next year. In 1815, Dr. Dodd steamed from Glasgow by Dublin to London in the *Thames*, which made a stormy passage of 758 nautical miles in 121 hours.

Steam navigation was introduced into France in 1815. In 1818, Napier's steam-packets ran regularly between Greenock and Belfast. It is said that, in 1819, the *Savannah* steamed from New York to Liverpool, but the assertion is very questionable. The *Comet* first carried the Admiralty pennant in 1822. In 1825, the *Enterprise* steamed from England to Calcutta in 113 days. Guns were first carried by the steamer *Salamander* in 1832.†

With respect to the various positions of paddle-wheels, it will be observed that most of those in earliest use were placed at each end of a shaft across the vessel. In Hull's plan (1736) the wheel was behind the stern; Bramah (1785), Miller (1787), and Symington (1801), placed the wheels in a passage inside the vessel open to the water. In Phillip's plan (1821) a wheel on deck turned on a vertical axis, and each float folded up to pass over the vessel. Submerged wheels on vertical axes were frequently patented. Sharples (1821) worked his wheel against the air; Harsleben (1826) placed the paddle-shaft at an angle to the horizon; Robertson (1829) and Perkins (1829) kept it horizontal, but inclined to the line of the keel, and the floats being turned at an angle in the opposite direction, entered the water in the usual way. Sharpley (1856) substituted for the wheel and floats a drum carrying a spiral rib; ‡ Bellford (1853) put the engine and cargo inside a hollow drum, with floats outside, that propelled it as the drum revolved.

Having thus noticed the paddle-wheel generally, as to when it was introduced, how it was turned, and where it was placed, we may proceed to consider various plans and inventions relating to its several parts, but it is to be distinctly understood that I refrain from comparing the relative merits of these different suggestions.

Beginning, then, with the shaft and wheel, as a whole, we find that Tremeere (1801) and Robinson (1826) supported it on a stage, to be raised and lowered by ropes. For the same purpose Melville (1845) used a cogged sector, and Drake (1851) employed screws;* Coles (1839) supported the shaft on friction wheels.

To enable the engineer to use only one wheel at a time, Gough (1828) put each on the shaft of a separate engine, while in Field's plan (1841) the wheel was disconnected by moving it and the part shaft horizontally. For the same purpose Wilkinson (1835) moved a sliding crank plate along the divided shaft, until the crank-pin locked into it. Brunet (1843) used a sliding ring and bolts; Thomas (1851) employed wedges and a friction cushion. In Seaward's plan (1840) the parts were coupled by friction surfaces, screwed up to close contact. Trewhitt (1840) tightened a friction strap by cutters; Bodmer (1843) and Borrie (1843) used cogwheels; Scott Russell's patent (1853) gearing worked by the motion of the shaft is applied to the *Leviathan*. Price (1823) used intermediate wheels to regulate the relative speed of the engine-shaft and paddle-shaft. The groove and stud apparatus of Parlour (1838) gave the wheel twice the speed of the engine-shaft.†

The modifications of the wheel itself are difficult to classify. Barton (1820), Sang (1852), Bellford (1853), and many others, made it a buoyant drum; Stevens (1827) put floats on three arms, not in the same plane. Springs were introduced by Adams (1839 and 1855) to ease concussion. Skene (1827) had side plates on the rims. In Tayler's plan (1840) one wheel might be covered from the water by a shield. Essex (1838), by dividing the wheel horizontally, folded back one part by hinges on the rim; while in Drake's plan (1851) the arms fold on hinges, like a fan. Galloway (1832) and Herbert (1855) attached an additional wheel, by a short shaft jointed to the outer end of the other, so that the rims of the wheels approached under water, and were more apart at the upper edges. Daubeny (1840) made the second outside wheel turn slower than the inner one, but in a parallel plane.

Let us next turn attention to the floats or paddle-boards, and first as to those that are immoveable on the wheel. Floats of the simple rectangular radial form were the earliest in use. Pitot (1729) put floats in planes tangential to the surface of a cylinder on the shaft; Perkins (1829) placed them at an angle to the shaft; Sharpley (1856) aggregated them into one continuous spiral rib; Galloway (1832) used two sets of floats, inclined in different directions; Chatterton (1842) and Stevens (1851) inclined each float in an opposite direction to the next, which projected beyond it at one end. Brooman (1852) put the oblique floats with one end further from the shaft than the other; Carter (1832) put a valve between each pair of inclined floats. This was to let out the backwater, which was effected in Pickworth's plan (1836), by louvre boards in the float, in Elvey's (1837) by a valve, and in Woodley's (1839) by holes bored diagonally through the float. Galloway (1835) divided the float horizontally, and put the parts successively in advance of each other. In Gemmel's plan (1837) the middle part was foremost, and Jones (1847) made the parts to overlap.

The edges of floats were curved by Robertson (1829). Ruthven (1830) made them of a barrel shape,‡ and there

* No description of the machinery of this vessel is given before that published, in 1816, by the Marquis de Jouffroy, who gives a sketch of the steam-boat. A copy of this is in the Great Seal Patent Office Library.

† The Emperor of Japan received a steam yacht, as a present from the Queen of England in 1858. The Chinese now use mock steam-boats, with paddles turned by men concealed inside.

‡ Both these last two methods tend to propel the vessel in a line inclined to the shaft, and, in this respect, their operation is intermediate between those of the paddle-wheel and screw-propeller.

* The connecting-rod had a screw joint, which allowed its length to accommodate itself to the varied distances between the piston-rod and the shaft.

† Murdoch (1839), Brown (1842), and Bodmer (1844), had plans somewhat similar.

‡ Hollow floats were used by Berry (1831), to condense the steam conducted through the arms.

is scarcely any other form which has not been proposed for them at one time or another.*

Floats were made moveable, for reefing, shipping, and feathering. For reefing, Parr (1825) made the floats slide on the arms with joints. Galloway (1843) placed the moveable pieces on a separate inside wheel, moving laterally on a hollow shaft, and Brunet (1843) placed them on different sides of the arm.†

Hall (1839) and Bird (1842) protruded them by a fixed spiral groove. They might be folded on hinges in Tremeere's plan (1801), and were worked through screw rods by Holebrook (1838). In Leeming's plan (1835) and Newton's (1843), each float protruded during part of every revolution. Redmund (1838) made them fall back by hinges as they revolved. Each float ran out and in by its buoyancy in Oxley's plan (1845).

The contrivances for feathering floats are numerous. In some cases, each float turns like an oar on a spindle, radial from the shaft, as in Duquet's plan, in 1693, where they feathered by fixed tappets. This was frequently patented afterwards. Two sets of such floats were used by Oldham (1820); Stead (1828) turned them by grooved guides, and Symington (1834) by cog-wheels. But the more common method was to cause the float to feather on a horizontal axis, parallel with the shaft. Silvester (1792) effected this by a spindle turned by a fixed cog-wheel; Broomfield (1825) made the principal cog-wheel adjustable by a screw; Steenstrup (1827) and Brown (1845) used an endless chain to regulate the angles of the float; Holebrook (1832) used a spindle, with a worm at one end and a pinion at the other. Curved rims, or cam-guides, feathered the floats by acting directly on catches, in the plans of Binns (1822), Pool (1829) and Winkles (1840). Parr (1825) caused the pressure of the water to feather the float on an axis dividing it unequally; Binns (1822) loaded the float so as to keep one edge always lowermost. This mode was repeatedly patented.‡ Skene (1827) combined these two last means, and bridle-bars were added by Vint (1835). Long before this, Lambert, in 1819, kept the free edges of the floats lowermost by attaching them all to a heavy circular rim without bearings.§ Parlour (1838) feathered the floats by a divided shaft, of which the part attached to the float spindles turned twice for each revolution of the other part.

In 1813, Robertson Buchanan patented his invention for feathering each float by a spoke from an arm on its spindle, jointed to a rim turning on a fixed excentric.

This application of the excentric was repeatedly patented, in various shapes, and many of the plans are so similar, if not identical, that it is evident their inventors were ignorant of what had been done before. It is to be regretted that, in many of these cases, from £300 to £500, besides often ingenuity, time, energy, and private expenditure, were thus needlessly thrown away; and it is to be hoped that, by the enlightened policy of the present authorities at the Patent Office, inventive energy will be delivered from a useless repetition of past efforts, and genius will be set free to cultivate new fields of labour.

* Some of these variations of form will be found in the following patents:—Perkins, 1829; Gemmell, Cave, and Hall. 1837; Rennie, 1839; Rapson, 1840; Joest, 1841; Biram. Lander. 1842; Smart, 1843; Handcock, 1844; Cartwright, Blyth, and Parlour, 1845; Barlow, 1851; Flynn, 1852; Scott, 1854; Bellford, 1855; Chatterton, 1855; Parkhurst, 1856; Crooker, 1857.

† Massie (1836), dividing each float into parts with parallel bars, caused one set to move over the other for reefing. For attaching the floats Hamond (1844) used wedges, while screws were employed by Brown (1847).

‡ Mercy (1825) tried to make the float feather by buoyancy, and Hill (1825) connected all the floats together by forked jointed pieces.

§ Cochrane patented this ten years afterwards, and Napier did the same in 1841; Miller (1848) added small guide rollers to steady the rim and increase the vertical pressure.

In 1827, Oldham put the feathering excentric on a hollow shaft, embracing the paddle-shaft, and so turned slowly, by fixed cog-wheels, as to cause the side edges of each float to point to the top of the wheel.

Bernhard (1828), Anderson (1828), and Giffard (1837), made the excentric adjustable, so as to regulate the angles of exit and entrance of the floats.*

In Lagergren's plan (1855), the rim on one side was higher than that on the other, and each float revolved on horizontal bearings, placed at its diagonal points.

Pickworth (1836) made each feathering float to consist of a frame carrying louvre boards on vertical spindles.

In Bramwell's plan (1851), an excentric motion and springs caused the arm and float to yield at the beginning of the stroke, and to work at greater angular velocity near the end. Ross (1856) gave to the outside edge of hinged floats a similar variable motion. The paddle floats of the *Leviathan* do not feather.

Among the few patents relating to paddle-boxes, we may notice Cochrane's (1818), for forcing smoke from the furnace into a closed paddle-box partly submerged, so as to exclude the water. Palmer (1839) did this by pumping in air, while Taylor (1848) allowed it to be forced in by the waves. Symington (1835) led the spray from the paddle-box to cool the engine; and the well-known paddle-box boats were patented by Smith in 1838.

We must go back again to early times for the first appearance of the screw-propeller. It is probable that, as the action of a watermill suggested the use of the paddle-wheel, so the motion of a windmill may have prompted the use of the oblique vaned propeller.†

In 1729, Duquet submerged an apparatus like a smoke-jack or windmill, and the action of the stream turned its shaft so as to wind up a rope.

In 1746, Bouguer states that "revolving vanes, like those of a windmill," had been tried for the propulsion of vessels, but it is not clear that the axis was turned by force inside the vessel, or that the method was an advance on that of Duquet.

The use of the screw-propeller in China may be of an indefinite antiquity. A model of one was brought from that country about the year 1780. It had two sets of blades, turning in opposite directions; but the first distinct description of the screw-propeller to be turned by machinery inside a vessel, seems to have been by D. Bernouilli, of Groningen, in 1752, and it is remarkable that this, though the earliest recorded proposal, was well enough matured to comprise the use of oblique vanes at the bow, sides, and stern, turned by a steam-engine, and capable of being hoisted out of the water. The woodcut (next page) representing the inventions of Bernouilli, is copied from one published A.D. 1803, in *Annales des Arts et Manufactures*, Tom. 20, Pl. II., p. 100.

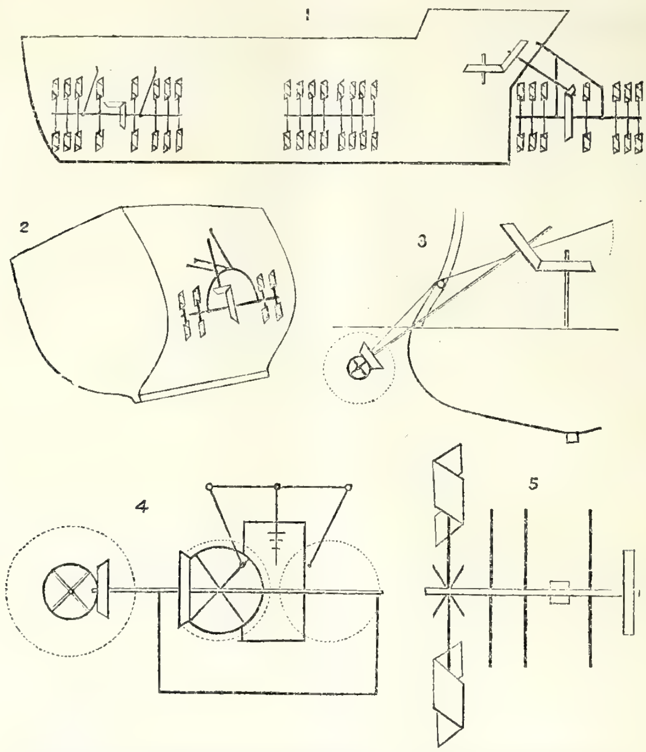
In 1768, Paucton proposed the pterophore, a screw thread on a cylinder, to be wholly or partly immersed. In 1770, James Watt suggested to Dr. Small the trial of a steam screw-propeller; Bramah, in 1785, first patented a rotary engine for this purpose; Ramsey (1792) put the screw between two hulls, and Lyttleton (1794) used a three-threaded screw, while Fulton (1798) tried one with four blades. Shorter's screw, (1800), with a jointed shaft,‡ and worked by men, was applied in 1802, to H.M. ships Dragon and Superb. The first screw steamer I can find was tried by Stevens in America§ in 1804. In 1825 Brown used one on the Thames.

* This is done by levers, or by a sector working a framework jointed to the rods that work the floats.

† The windmill is of an unknown antiquity. There is an interesting description of it by R. Hooke, in 1681. It will be observed that under the term "screw-propeller," we include every rotating propeller with oblique vanes which urges the vessel in a direction parallel to the propeller shaft.

‡ Patented again by Phipps, 1850, with a moveable outside bearing, and by many others.

§ Worked first by a rotary engine, afterwards by Watt's reciprocating engine. In this year, 1804, Boaz made experiments



1. Side view of Bernouilli's Screw Propellers at the bow, side, and stern of a vessel.
2. Three-quarters view of the side propeller.
3. Stern view of ditto, with a cross section of the vessel.
4. The steam-engine.
5. Enlarged view of the propeller.

The only patent for combining the screw-propeller and paddle-wheel is that of Turck, in 1852. The Bee, a naval steam-tender at Portsmouth has carried both paddles and screw since 1842, but they are not worked together.

Screw-propellers are so various in form that we can scarcely arrange them for consideration according to their shapes or modes of action.* It will be better to group the inventions according to the several parts of the apparatus they relate to. And first, with respect to the general arrangement of the whole apparatus, there is scarcely any position under or above water all round the vessel which has not been proposed for the screw-propeller; indeed most of these varieties of position were exhausted by the earliest plans.

The first English patent relating to the subject is Miller's, in 1775. Here the blades are at the end of the arms of a windmill on a vessel's deck, with its axis parallel to the keel. Duncan (1851) put the blades on an endless strap, running outside over the deck and round the hull. He suggested also (1856) that a spiral rib, wound round a floating cylinder, should act for propulsion as the cylinder is caused to turn.*

Bernouilli and Shorter, having suggested propellers at the bow, sides, and stern of a vessel, Cummerow, in 1828, placed one in an opening in the stern deadwood, which is now the usual position.

Taylor, again (1838 and 1846), using two propellers on separate shafts, brought them so near that the blades overlapped and passed between each other. Napier (1841) placed one of the approximated propellers astern of the other. Carpenter (1851), put two propellers in separate stern-pieces. Bucholz (1851) had three of them, and placed the middle one astern of the others. In all these cases the shafts were on the same level, but Tombs (1856) placed the shaft of one (the aftermost overlapping propeller) a short distance above the other shaft, to which it was geared,† so as to turn in an opposite direction.

Next, we must notice different propellers on the same

with the screw. The following information is extracted from the Board of Trade papers:—Total number of steam-vessels registered up to Jan. 1, 1857, 1668, of which there were wooden, with paddle-wheels, 820; with screw propellers, 19, total of wood, 839. Iron, with paddle-wheels, 356; with screw-propellers, 473; total of iron, 829. From the Navy List, we learn that there are at present, in the Royal Navy, wooden steamers with paddle wheels, 67; with screw-propeller, 160; and 185 gunboats. Iron steamers with paddle, 15; with screw, 10; with both paddle and screw, 1. Total number of war-steamers, 427, carrying about 16,000 guns, and of 86,000 horse power. In 1814, there were only 2 steam vessels belonging to the British empire. These had increased, in 1855, to 2,010, of 408,290 tons. The number of steam-vessels has doubled since 1845, and their tonnage increased threefold. The first iron steam-vessel was made in 1822. In 1856, 54 wooden and 175 iron steam-vessels were built, (tonnage 57,573) and 35 of both kinds were wrecked. Within the last 12 years, about 20 large mail packets have been lost. Since 1853, 2,000 persons have perished, and ten millions of dollars worth of property have been destroyed in the wrecks of the United States coasting mail packets.

A general division may be made into two classes. In one (as in the plans of Bernouilli and Bouguer) no thread continues through an entire revolution. In the other a helical thread has at least one revolution (as in the the plans of Duquet and Paucton).

* A similar mode of propulsion used by an insect is noticed near the end of this paper.

† Morrison (1854) placed on e propeller "above the other."

axis. Perkins patented this plan* in 1824, placing one shaft within the other, and turning the screws in opposite directions. Church patented it in 1829, and Ecrisson in 1836, when a hoop with short vanes was used instead of blades.

Such were the positions of the propeller when in use; but it was soon found needful to have a power of altering the position, so as to hoist it out of the way. For this purpose, Bernouilli (1752) put hinges on the rods supporting his side propellers, and detached the propeller from the shaft at the stern.†

In Shorter's plan (1800) the shaft had a universal joint, which allowed the propeller to be raised; Pumphrey (1829) detached the propeller at this joint; Taylor (1838) disconnected the shaft by drawing inwards the engine part, so that the propeller could be raised in vertical guides; Maudslay (1846) used a similar plan, and screwed one part of the shaft into the other, to connect them again; Galloway (1843) and Griffiths (1853) disconnected the whole apparatus by chains, which extricated the shaft from the bearings successively; Seaward (1846) lifted the propeller by rods which were screwed into the boss.‡ The propeller was raised in a different manner by Perkins (1845) and Tucker (1850), who put it on an arm turning vertically round a horizontal pin above the shaft.

Some other inventions relating to the propeller shaft may be briefly noticed. Thus Buchanan (1846) supported the shafts on springs. Montgomery (1846) and Hunt (1854) made it yield to a twisting strain. Wimshurst (1850) and Prideaux (1853) inserted a dynamometer between its parts. Blaxland (1840) put the shaft on a single spherical bearing, so that its inner end could be raised.

Various plans were suggested for receiving the horizontal thrust of the shaft. Hays (1844), Buchanan (1846), and Prideaux (1853), received the end of the shaft in a water-box; Penn (1845) upon a steel plate, revolving so as to present new surfaces to the point; Beale (1848) deflected part of the thrust along other transverse shafts by bevilled wheels. A common groove and furrow bearing is used in the *Leviathan*. Penn (1854) put wood to work on metal for the bearings under water; Buchanan (1854) placed two shafts one above the other, and the propeller could be attached to either as the vessel was loaded; Napier (1856) worked the propeller shaft at different elevations by an adjusting vertical shaft and cog wheels; James (1857) pumped water through it to be discharged at the ends of the blades, and thus to turn them.

To regulate the speed of the shaft, (Galloway (1843) had a multiplying gear of bands and wheels. Maudslay (1843) used drums and an endless rope. Hays (1844) inserted an additional shaft and cogwheels, while Griffiths (1849) applied the sun and planet motion. Robertson (1856) used grooved friction wheels, and Struthers (1856) geared one shaft to the other by a cog wheel with internal teeth. Bodmer (1844) caused the propeller to turn with a velocity, alternately increasing and decreasing. Hunt (1854) connected the shaft with the throttle-valve, so that the steam was regulated by the degree of pitch of the blades; Roberts (1851) made the boss much larger than usual; and Griffiths (1849) tapered its after end to a conoidal point, and other forms of the boss were applied in connection with moveable blades.

The forms proposed for propeller blades, both for outline and section, are innumerable. It is hoped that in noticing only a few, no injustice will be done to the other twists and curves and fanciful forms, so many of which remain unknown to fame.*

We shall direct our attention first to blades not moveable on the shaft. In 1825, Marestier had a screw of a "helicoidal surface." Woodcroft (1832) patented a propeller with an increasing pitch,† Smith (1836) used two threads of a half turn each at the ends of a diameter.

In the plans of Lowe (1838) and Borrie (1843) each blade revolves in a different plane. Haddan (1839) fixed two spirals at a distance from the shaft; Poole (1848) patented the "Bommereng" propeller, in which a bent blade turns about its centre of gravity in the shaft; Joest (1841) shortened every alternate blade; Dundonald (1843) bent them towards the stern; Griffiths (1849) towards the bow, or alternately each way.

Samuda (1843) put the blades projecting inwards from a hollow drum. The surface they presented was made elastic in the plans of Duncan (1816), Macintosh (1847), Hendryckx (1850), and Hunt (1854). Oxley (1845) made it expansible by wedge pieces. Amongst other forms were Sunderland's (1843), and Southworth's (1846), bounded by areas of circles; Griffiths' (1849) open in the centre, or with blades like lancets,‡ and Lowe's (1852) with an indescribable twist.

The blades were made moveable on their radial axes in the boss by Millington, in 1816.

Woodcroft (1844) effected the adjustment by a rod lying along the shaft, jointed at one end to a short arm on the blade, and carrying at the other end a stud, which takes into a groove in a short box or hollow piece, traversing the shaft on feathers.§

Woodcroft, in 1851, used another form of boss, by which the blades could be so turned on their axes, while the shaft revolved, as to operate on the water with their reversed sides, and thus to back the vessel without stopping the engines.

Hays (1844) altered the blade's angular position by screwing up a ring. Bodmer (1844) placed one pair of blades loose on the shaft, so as to be properly set as they revolved, and to rest vertically behind the false stern-post. For the like purpose Malo (1850) put the pairs of blades on different shafts, one being hollow.

Buchanan (1846) made the water turn the blade on its radial axis, and fixed it by clutches.‖

Wingate (1857) turned the blade by a key, and fixed it by the friction of its conical shank in the boss.

In 1849, Griffiths caused the pitch of the blades to be altered by levers, according to the speed of the shaft. Burch (1852) substituted a large plate for the boss, and the blades thus projected beyond the ordinary hull lines

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* The Chinese propeller seen by Col. Beaufoy, in 1780, had two screws turned in opposite directions, but they may have had separate axes. The plan of Perkins was patented afterwards by Smith (1838). Dugdale (1849) put several propellers on the same shaft.

† Others left the propeller free to revolve as the vessel sailed. Slaughter (1849) helped it to do so without resistance by a "donkey engine."

‡ Wimshurst (1850) used a similar plan, and disconnected the parts by withdrawing bolts; Wilson (1852) caused the propeller to be hoisted by screwing itself along the inclined shaft; Oxley (1845) enclosed the space occupied by the propeller (when at rest vertically) with water-tight doors, in a chamber kept dry by compressed air.

* The propeller blades of the *Leviathan* are fixed, and of a common form.

† A right angled triangle, wound upon a cylinder, traces a screw by its hypothenuse. When a spiral curve is put instead of the hypothenuse the screw will have an increasing pitch. Fraissinet (1838) used a parabolic curve, and Rennie (1839) applied another curve. Beadon (1845) and Templeton (1846) made the blades of a volute form—Rosenberg (1845) reversed the usual curvature, by making the blade near the boss parallel to the shaft.

‡ Griffiths (1849) proposed to determine the best form o curved blade by using balls floating in the wake of the propeller, so as to indicate the forces acting at different points by spring balances.

§ A full-sized model of this plan is placed in the Patent Museum, at Kensington. In 1851, the same patentee used a hollow shaft with a cog wheel acting on a pinion on each blade. The plans of Hays (1845) and Brown (1847) were nearly similar.

‖ Griffiths (1853) adjusted the blades from the deck by a key working a bolt in the boss.

of the stern, which were continued aft beyond the propeller. Paterson (1857) produced a similar effect by using for the boss a large conical drum, coinciding at the foremost end with the shape of the vessel, which was terminated by a round vertical plane.

The screw-propeller was caused to steer the vessel by altering the direction of the shaft or the angular position of the blades. Shorter (1800) and Millington (1816) used the first plan, turning the shaft to one side or another by a Hooke's joint. Pumphrey (1829), Buchanan (1853), and Abadie (1854), attached the shafts to a frame moveable laterally with the rudder; and Bucholz (1851) geared each of his three propellers in a ring, which allowed the axis to be directed for steering.

The second mode of steering was adopted by Woodcroft (1851), who attached each blade by an arm to a rod with a stud in the groove of a box on the shaft inside the vessel. The direction of the groove could be so altered by switches as to cause the blade to act with its broadside during one part of each revolution, and thus to impel the stern to one side or another. When the blades were stationary, in a vertical position, they might be turned on their axes, so as to act like an ordinary rudder.

Foulevton (1844) and Wimshurst (1850) placed a screw on an axis athwart the vessel, so as to steer by revolving in one or the other direction.

In the modes of propulsion adopted by aquatic animals may be found almost every plan which has been used by man with machinery. Thus water is ejected for propulsion by the cuttle fish and "paper nautilus;" sails are used by the velella and water birds; punting and towing by whelks and the lepidosiren; a folding paddle by the lobster, feathering paddles by ducks, and oblique surfaces by fish of all kinds. A screw-like appendage is found in the wings of an Australian fly, but it is supposed to be shaped thus only when dried after death. There is, however, one remarkable animal which propels itself by a rotary movement, acting on the water by means very similar to those of the paddle-wheel and screw-propeller combined. This is the infusorial insect Paramecium. My attention was called to this miniature Leviathan by Mr. Robert Mallet, and after some months of ineffectual search, I was fortunate enough to see its operations distinctly in one of Mr. Tomkins' splendid microscopes. The form is represented in the accompanying woodcut. A sulcus or furrowed grove

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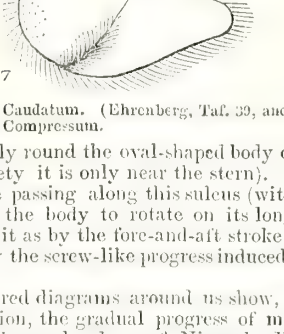

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6. Paramecium Caudatum. (Ehrenberg, Taf. 39, and pp. 351, 353.)
7. Paramecium Compressum.

runs obliquely round the oval-shaped body of the animal (in one variety it is only near the stern). A wave-like protuberance passing along this sulcus (with or without cilia) causes the body to rotate on its longer axis, and thus propels it as by the fore-and-aft stroke of a paddle, as well as by the screw-like progress induced by the spiral groove.

The coloured diagrams around us show, without verbal explanation, the gradual progress of marine propulsion from the early days of Nineveh, Babylon, and Egypt. We have traced its more particular application in the rotatory action of the paddle-wheel and screw, and have seen these combined in one of nature's smallest works. Let us hope that the giant vessel now afloat will be a great success, bearing forth our sturdy emigrants to lands of plenty—honest English hearts to shores of commerce—strong hands to works of industry—strong minds to stores of knowledge—brave armies to fields of glory—and the gospel of peace to the ends of the earth.

DISCUSSION.

The Chairman said he was sure they had listened with pleasure and profit to the admirable paper of Mr. MacGregor, which could not fail to be useful in assisting inventors to avoid wasting their energies in inventing over again that which they would probably find had been invented before. He feared it was not generally believed that the faculty of mechanical invention was not a very unusual faculty—that it belonged to nearly everybody, and that it was one of the greatest misfortunes that could fall upon a man when he took it into his head that he was endowed with a larger portion of that faculty than anybody else. He could assure them that that was the thing which practical engineers were most afraid of in themselves. They had to be constantly guarding themselves against the temptation to invent, for it was a much safer course to be contented with exercising their judgment on the inventions of others. Invention, then, in mechanics, he did not think at all a distinguishing faculty; and he believed there were men in this country who could invent anything they were asked for, and all we had to do was to pay them for inventing. Therefore, he advised most people not to invent, but to pay other people, who had nothing else to do, to invent for them; they would find it much cheaper. Of the hundreds of inventions that had passed through Mr. MacGregor's hands in the extensive research he had had undertaken in preparing this paper, were they not amazed to see how few were at this day in practice; and were they not struck with the fact that nearly all the inventions they now heard of no more seemed monstrously ingenious, whilst the inventions actually in use were those which appeared to have got rid of all the ingenuity, and to have merely retained one or two plain, simple, common sense elements in them. Now, that was the lesson which he would wish Mr. MacGregor's paper to have taught to that audience, especially the younger members, and that was the lesson he hoped it would teach to the mechanical world at large in the wider sphere of its influence when published in the *Journal* of the Society. There was another very good rule which might be laid down, and that was that no man should set about inventing anything but what had reference to his own trade. He remembered a person coming to him and saying, "I wish you would find a situation for my brother on a railway or steamboat, or anything else that you are connected with." He asked him what his brother was, and he replied that he was a portrait painter, while he himself was a house painter; and he (Mr. Russell), then asked him why he thought his brother would be more useful in one of the occupations he had mentioned, rather than in assisting him in house painting, which he (Mr. Russell) thought was more closely allied to portrait painting. He, therefore, humbly suggested this to him, as being better and more appropriate than an employment either on a railway or a steam-boat; to which his Scotch applicant replied, that his brother might do very well for a railway, or a steam-boat, or anything else, but he would never make a house painter. He continually had gentlemen coming to him and inventing for him something to assist him in his business, of which they began by telling him they knew absolutely nothing, and when, in return, he ventured to suggest the propriety of devoting a little of their spare time, which they devoted to his trade, to the making of better shoes or coats,

which might be their own business, he was sorry to say he was treated with the greatest disdain for presuming to give advice in a matter of which, of course, he knew nothing whatever. He had now to ask gentlemen whom he saw present to give them any additional facts on this subject that they might be acquainted with, and he would merely set the example by stating that, previously to the year 1830, he saw a steam-boat propelled by the screw, and it reached a speed of from 5 to 6 miles an hour. The results were communicated to the Admiralty, prior to 1830, by the late Mr. Adams, of Edinburgh, and there was a commission appointed to investigate the subject, who reported upon it unfavourably. With reference to Mr. MacGregor's researches, he thought the public was very much indebted not only to him, but also to Mr. Bennett Woodcroft, of the Patent Commission, who had, for the first time, made the vast stores of ingenuity deposited in the Patent-office accessible to the public at large, and who had also formed the nucleus of a Museum of Inventions, which he had no doubt, within the next five-and-twenty years, would be one of the most remarkable and interesting institutions in the British empire. That museum was now partly collected in the Patent-office in Chancery-lane, and partly at the Kensington Museum. The Society of Arts had endeavoured to assist in obtaining some large public building to be set apart for collections of models and records of inventions, in order that inventors might at a glance see all that their predecessors had done. He thought, perhaps, Mr. MacGregor was not aware that a propeller had been introduced by Mr. Rennie, in which he used a diamond-shaped or triangular float instead of a parallelogram, and some advantages were said to result from this arrangement.

Mr. George Rennie said, although he did not class himself amongst those unfortunate inventors who had thrown away their time in useless inventions, yet he could not but confess that he had been somewhat of a dabbler in invention. His first notions of screw propulsion were not come to by chance, but were arrived at after mature consideration of the question. While he was trying experiments on the resistance of water, he found that on revolving two square boards through the water, at the extremities of radii, they presented a certain resistance, which was as the squares of their velocities. It was clear that the outer portion of these floats moved with a greater velocity than the inner portion, and that consequently there must be a point between these two which would represent the centre of resistance. He reasoned upon that, and the conclusion he came to was, that he would obtain an advantage by taking off a portion of the inside of the float. He therefore took off two corners of the square, and caused it to revolve in the water, and he found the resistance to be as great as before. He ultimately arrived at a form much resembling the duck's foot—a triangle; thus following one of the most perfect adaptations of nature. The same principle was seen in the formation of the wings of birds and the tails of fishes, and it was found that the more acute the tails of the fishes and the wings of birds were, the faster they moved. Mr. Rennie added that he had had the satisfaction of seeing his discoveries taken up by no less a person than Mr. Ewbank, of New York, who made a series of experiments with the various forms of floats, and found that the triangular floats, in whatever position they were placed, exercised the greatest power in propulsion. His next attempts were directed to the screw propeller, and it occurred to him that the object of the screw was not merely to drive the vessel through the water, but that it should also be of such a form as to pass the water easily. Mr. Rennie concluded with a description of a screw propeller which had been designed by himself, called the "Conoidal Propeller."

Mr. Grantham felt great pleasure in responding to the invitation of the Chairman, although he feared the little he could say upon the subject would not be of any great interest to those present. It was true he was early engaged in the investigation of this subject. He was much interested by and fully concurred in the very excellent advice which the Chairman had given to the class of people who looked upon themselves as inventors. It so happened that he (Mr. Grantham) occupied a position in Liverpool similar to that of the Chairman and other gentlemen in London, and he was frequently called upon to give similar advice. Inventors often came to him with some adaptation as they called it, of the laws of nature applied to mechanics—the fish's tail, the duck's foot, or something of that sort, and they argued that their plan which was an imitation of one of those organic structures must be a good one because it was the plan which the Almighty had adopted in forming those creatures and in adapting their organisation to the sphere of existence in which they were placed. He thought this question was simply set at rest by the reflection that if the fish's tail was the best propeller, why had the Almighty formed the duck's foot to be used for this purpose? and if the duck's foot was the best propeller because it constituted a feathering float, why had the Almighty also formed the tail and the fins of the fish to answer the purpose of propellers? He had no intention to treat this subject lightly, but he said this in order to check the propensity which so many persons had to run wild on those matters. He had been very much interested by the paper of Mr. MacGregor, but there were one or two points in it in which he thought the inquiry might be extended a little further. With reference to the paddle-wheel, Mr. MacGregor was, perhaps, not acquainted with an American invention that had been applied to one or two large vessels, but as it came so soon before the introduction of the screw it succumbed to that, which was now generally held to be the best method of propulsion. This plan consisted of submerged paddle-wheels, which corresponded, in some measure, with Galloway's invention of the water-tight paddle-box. There were two small wheels on the sides of the ship completely submerged. The paddle-boxes were water-tight in all parts except at the bottom. The wheel itself was formed of a closed drum or cylinder, with floats on the outer periphery. The wheels were set in motion by a shaft going through the ship's sides, and being made to revolve at a moderate speed, it was found that the centrifugal force at the periphery of the wheel was sufficient to exclude all the water from the inner part of the paddle-box, so that the whole effort was in the right direction for driving the ship—at the bottom part of the floats. With reference to the screw, his attention was, at first, more particularly directed to the means of driving the screw rather than to the form of the screw itself, and this was a very important element in screw propulsion. In 1843 he read a paper before the Institution of Civil Engineers, descriptive of a small vessel, called the Liverpool screw, which had been built, he believed, in the previous year, and in which, for the first time, the screw was driven in a simple manner direct from the engines. Many interesting experiments were made with that vessel. It was the subject of several evenings' discussion before the Institution, and it would surprise them to hear that at that time there was scarcely one out of the whole number of eminent engineers there assembled, who thought it feasible to drive a screw direct from the engines. That was in 1843. Of course they were all aware now that the prevalent mode of driving the screw was direct from the engines, as it was not only found to be perfectly feasible, but also, he believed, the simplest and best plan. The results of the experiments with that vessel were extremely interesting, although they were not much noticed at the time. He might mention that the same vessel was still at work, and having been lately through his hands was found to be in excellent order. There was one interesting feature which he mentioned at the time his paper was read, which he had not seen noticed in any of the experiments with the screw-propeller. The

trial was made in the Mersey in fine weather and smooth water. The vessel was first driven at full speed a-head, and then stopped suddenly and the engines reversed. It was then found that the vessel, as is usual in screw propulsion, swung round several points, until she begun to make stern way, when she immediately began to steer as before and kept on perfectly straight. It was then a prevalent idea that the lateral motion of the screw would act very much against the steering of the ship, and that a loss of power, and, consequently, of speed would result. As the vessel was very light, by trimming her with some pig iron, at least one-third of the screw was raised out of the water, and when it was in that condition he again tried experiments as to the steering qualities of the ship. The result was that when she was under way he could, with one finger on the spoke of the wheel, easily steer her in any direction, showing how very little oblique action there was in a well-made screw, when the vessel was in motion; and this was also shown in the before-mentioned experiment of reversing, which proved that while the vessel was going in an opposite direction to the screw there was an immense lateral action, which caused the vessel to swing round, but when the vessel moved in the same direction as the screw the effect was altered. This went to show that the lateral action ceased to a great extent when the ship was going with the screw, and that the fears as to the loss of power in the screw were to a great extent groundless.

Mr. Charles Atherton thought they must all be struck with the remarkable manner in which Mr. MacGregor had verified the old proverb, "There is nothing new under the sun." The only point on which he would offer any observations was, that although in times past there had been such an immensity of invention yet it had lain dormant, and it seemed to be the province of the present age to utilise those inventions which for so long a time remained unknown. It was remarkable that amidst the numerous kinds of screw which had been invented, it was impossible for any one at the present day to say which was the best. In the position which he occupied, a great many different plans of screws naturally came under his notice, and he might have had particular fancies with regard to some of them; but generally speaking mere individual opinions were wrong, inasmuch as some essential point of an invention was often overlooked. He might instance the screw introduced by Griffiths. When that was first introduced, the general opinion was, that width at the end of the screw was desirable in order to gain power; but in Griffith's screw the fan was nearly the shape of a heart. Although that was the reverse of what they had supposed to be a necessary condition of a screw, still he was not prepared to say that it was inferior to any other form of screw; and he even believed it was in a position to compete successfully with any other. He did not appear as the advocate of any particular screw, but he contended that practical experience alone must decide the question of superiority. When they came to the practical part of the question, he thought it was very desirable that engineers should fix some standard by which to judge as to what should be regarded as a really reliable experiment, so that they should be able to discern between a good result and a bad one, which certainly was not the case in the so-called trial trips of the present day. He also thought it very desirable that proprietors and agents of screw steam vessels should furnish engineers with the statistics that they had in their possession, and which were necessary to the investigation of these points. By so doing they would not only promote the advancement of science, but at the same time further their own private interests.

The Chairman said it was now his duty to propose that they should return their warmest thanks to Mr. MacGregor for his admirable paper, which was so well calculated to promote the advancement of manufactures and mechanical invention, and to thank him also for the very valuable services which his laborious researches on this subject, and his judicious elucidation of the relation of these inventions to one another had conferred upon mechanics in general, and especially upon those younger men who were growing up as mechanics, to whom we must look for the carrying out of inventions in the next generation as successfully, and, he hoped, still more successfully, than they were carried on in the present generation.

The Earl of Caithness had great pleasure in seconding the motion. When they considered how much ingenuity had been bestowed on such a variety of screws and floats, it was almost surprising to find that any attention was paid to the accommodation of passengers and merchandise. But so admirable were the arrangements of the present system of marine propulsion, that not only was ample accommodation afforded for passengers, but very large space was secured for merchandise, whilst a speed had been attained on the ocean which a few years ago was thought to be impossible. He recollected when Mr. Taylor first proposed to Mr. Miller, of Dalswinton, to put an engine into a boat, the idea was laughed at, but after consideration Mr. Miller yielded to the request, and the engine was furnished by Symington. The vessel was tried, and the beautiful picture of Dalswinton on the table was evidence, if any were wanted, that such a thing took place. The steam-engine, as applied to vessels, had gone on progressing from year to year until we were not contented with the small vessels afloat, but had now to contemplate its application to the immense ship which had been built by his friend Mr. Scott Russell; and he was sure that all present most earnestly hoped that she would turn out a success, and would prove to be the finest vessel afloat. The magnitude of this vessel was such, that although her commander and many naval officers, as well as her projectors, entertained not the slightest doubt of her success, yet, as a hitherto untried experiment upon so grand a scale, the result would be looked to with the deepest interest by all. It was easy for the Chairman to recommend people not to invent, but the difficulty was for any one to keep himself from inventing. They might almost as well tell people not to think, as tell them not to invent. At the same time he considered that Mr. Scott Russell had given them all very excellent advice, and he (Lord Caithness) would join in the advice given—that before they began to invent they should ascertain whether the same thing had not been invented before. He could speak from his own knowledge and experience that when he thought he had conceived some grand idea, he often found it had been given birth to many years before. He thought they were not only obliged to Mr. MacGregor for his admirable paper, but they were also indebted to Mr. Scott Russell for his wholesome advice and his conduct in the chair.

A vote of thanks was then passed to Mr. MacGregor.

The Paper was illustrated by a very large number of sketches and diagrams, made by Mr. MacGregor, as well as by numerous models, kindly lent from the Museum of the Commissioners of Patents.

At the conclusion of the discussion, Mr. C. Wentworth Dilke, Chairman of the Council, announced the decision of the Council in reference to the intended Exhibition of Industry and Art in 1861, and read the resolutions given on the first page of the present number of the *Journal.*

The Secretary announced that on Wednesday evening next, the 21st inst., a Paper by Mr. C. W. Siemens, "On the Progress of the

Electric Telegraph," would be read. On this evening, Mr. W. R. Grove, Q.C., F.R.S., will preside.

MIDDLE CLASS EXAMINATIONS.

The University of Cambridge have issued the following Regulations for the year 1858 concerning the Examination of Students who are not members of the University:—

There will be two Examinations, commencing on Tuesday, December 14, 1858; one for students who are under 16 years of age, and the other for students who are under 18 years of age.

Students will be examined in such places as the Syndics, appointed by the University, may determine.

After each Examination the names of the students who pass with credit will be placed alphabetically in three honor classes, and the names of those who pass to the satisfaction of the Examiners, yet not so as to deserve honors, will be placed alphabetically in a fourth class. After the name of every student will be added his place of residence, and the school (if any) from which he comes to attend the Examination.

In determining the classes, account will be taken of every part of the Examination; but no credit will be given for knowledge in any subject, unless the student shows enough to satisfy the Examiners in that subject. Regard will be paid to the hand-writing and spelling throughout the Examinations.

The students who pass with credit, or satisfy the Examiners, will also be entitled to receive certificates to that effect. Every certificate will specify the subjects in which the student has passed with credit, or satisfied the Examiners, and the class in which his name is placed.

Every one admitted to Examination will be required to pay a fee of twenty shillings.

Examination of Students who are under Sixteen Years of Age.

Students must be under 16 years of age on the day when the Examination begins.

Part I.—Preliminary.

Every student will be required to satisfy the Examiners in

1. Reading aloud a passage from some standard English prose author.
2. Writing from dictation.
3. The analysis and parsing of a passage from some standard English author.
4. The first four rules of Arithmetic, simple and compound, Vulgar Fractions, Practice, and the Rule of Three.
5. Geography:—Every student will be required to answer questions on the subject, and to draw from memory an outline map showing the coast line, the chief ranges of mountains, and the chief rivers of one of the countries in the following list:—England, Scotland, Ireland, Europe, Asia, Africa, North America, South America, Australasia.
6. The outlines of English History since the Conquest; that is, the succession of Sovereigns, the chief events, and some account of the leading men in each reign.

Part II.

The Examination will comprise the subjects mentioned in the following ten sections: and every student will be required to satisfy the Examiners in three of those sections at least, but no one will be examined in more than six. Section I. must be one of the three, unless the parents or guardians of the student object to his examination in that section.

1. Religious knowledge: Questions will be set on—

(*a*) The two Books of Samuel, the Gospel of St. Matthew, and the Acts of the Apostles:

(*b*) The Church Catechism:

(*c*) Whateley's "Easy Lessons on Christian Evidences."

Every student, who is examined in this section, will be required to satisfy the Examiners in the subject marked (*a*), and in one at least of the subjects marked (*b*) and (*c*).

2. English:—Every student, who is examined in this section, will be required to write an original English composition. He will also be examined in English History, from the battle of Bosworth field to the Restoration: Physical, Political, and Commercial Geography: Trench, "On the Study of Words."

3. Latin:—Passages will be given from Sallust's "Bellum Catilinarium" and Virgil's "Æneid," Book VI. for translation into English, with questions on the parsing and the historical and geographical allusions: Also an easy passage for translation from some other Latin author: And a passage of English, with Latin words supplied. for translation into Latin.

4. Greek:—Passages will be given from Xenophon's "Anabasis," Book II., and Homer's "Iliad," Book VI., for translation into English, with questions on the parsing and the historical and geographical allusions: Also an easy passage for translation from some other Greek author.

5. French:—Passages will be given from Voltaire's "Charles XII.," for translation into English, with questions on the parsing and the historical and geographical allusions: Also a passage from some modern French author for translation into English: And easy English sentences for translation into French.

6. German:—Passages will be given from Lessing's "Fables," prose and verse, for translation into English, with questions on the parsing: Also a passage from some modern German author for translation into English: And easy English sentences for translation into German.

7. Pure Mathematics:—Every student, who is examined in this section, will be required to satisfy the Examiners in Euclid, Books 1 and 2, Arithmetic, and Algebra to simple Equations inclusive. Credit will be given for a knowledge of Book-keeping. Questions will also be set in Euclid, Books 3, 4, and 6, in Quadratic Equations, Progressions, Proportion, Plane Trigonometry not beyond the solution of Triangles, the use of Logarithms and Mensuration.

8. The elementary principles of Mechanics and Hydrostatics:—Questions will be set, embracing the proofs of the leading Propositions. In Mechanics they will not extend beyond the parallelogram of forces, the centre of gravity, and the mechanical powers. In Hydrostatics they will not extend beyond the transmission of fluid pressure, the equilibrium of inelastic fluids and of floating bodies, and the description of the steam engine and of simple hydraulic machines. A fair knowledge of Mechanics will enable a student to pass in this section.

9. Chemistry:—Questions will be set on the elementary facts of Chemistry, and the laws of chemical combination. Solutions will be given to be tested, containing not more than one acid and one base.

10. Zoology and Botany:—Elementary questions will be set on the description and classification of animals, their habits and geographical distribution; and on the mercantile and industrial uses of animal products: Also on the description and classification of Plants, their uses and geographical distribution: British plants and parts of plants will be given for description.

Part III.

Students may also offer themselves for Examination in

1. Geometrical and Mechanical Drawing.
2. Drawing from the Flat, from Models, from Memory, and in Perspective.
3. The Grammar of Music.

Examination of Students who are Under Eighteen Years of Age.

Students must be under eighteen years of age on the day when the Examination begins.

Part I.—Preliminary.

Every student will be required to satisfy the Examiners in

1. Reading aloud a passage from some standard English poet.
2. Writing from dictation.
3. Analysis of English sentences and parsing.
4. Writing a short English composition.
5. The principles and practice of Arithmetic.
6. Geography.

Every student will be required to answer questions on the subject, and to draw from memory an outline map of some country in Europe, showing the boundary lines, the chief ranges of mountains, the chief rivers, and the chief towns.

7. The outlines of English History; that is, the succession of Sovereigns, and chief events, and some account of the leading men in each reign.

Part II.

The Examination will comprise the subjects mentioned in the following eight sections; and every student will be required to satisfy the Examiners in three at least of the sections marked A, B, C, D, E, F; or in two of them, and in one of the sections marked G, H; but no one will be examined in more than five. Section A must be taken by every student, unless his parents or guardians object to his examination in that section.

Section A.

Religious Knowledge: The Examination will consist of questions in

1. The Historical Scriptures of the Old Testament to the death of Solomon. The Gospel of St. Luke and the Acts of the Apostles. Credit will be given for a knowledge of the original Greek.

The Morning and Evening Services in the Book of Common Prayer, and the Apostles' Creed.

3. Paley's "Horæ Paulinæ."

Every student who is examined in this section will be required to satisfy the Examiners in the subject marked 1, and in one at least of the subjects marked 2 and 3.

Section B.

1. English History, from the battle of Bosworth-field to the Restoration; and the outlines of English Literature during the same period.
2. Shakspeare's "Julius Cæsar (Craik's edition).
3. The outlines of Political Economy and English Law.

The Examination will not extend beyond *subjects* treated of in the first book of Smith's "Wealth of Nations" and the first volume of Blackstone's "Commentaries.

4. Physical, Political, and Commercial Geography.

A fair knowledge of one of these four divisions will enable a student to pass in this section.

Section C.

1. Latin: Passages will be given from Livy, Book xxi., and Horace, "Odes," Book iii., for translation into English, with questions on the historical and geographical allusions, and on Grammar: Also passages for translation from some other Latin authors: and a passage of English for translation into Latin.

2. Greek: Passages will be given from the "Olynthiacs" of Demosthenes and the "Alcestis" of Euripides, for translation into English, with questions on the historical and geographical allusions, and on grammar. Also passages for translation from some other Greek authors.

3. French: Passages will be given from La Bruyère's "Characters," and Molière's "Misanthrope," for translation into English, with questions on grammar. Also passages from some other French authors for translation into English; and a passage of English for translation into French.

4. German: Passages will be given from Schiller's "History of the Revolt of the Netherlands, and Goethe's "Hermann and Dorothea." for translation into English, with questions on the historical and geographical allusions, and on grammar. Also passages from some other German authors for translation into English; and a passage of English for translation into German.

A fair knowledge of one of these four languages will enable a student to pass this section.

Section D.

Every student, who is examined in this section, will be required to satisfy the Examiners in Euclid, Books i., ii., iii., iv., vi., and xi. to Prop. 21, inclusive. Arithmetic and Algebra.

Questions will also be set in the following subjects:—

Plane Trigonometry, including Land-surveying.

The simpler properties of the Conic Sections.

The elementary parts of Statics, including the equilibrium of forces acting in one plane, the laws of friction, the conditions of stable and unstable equilibrium, and the principle of virtual velocities.

The elementary parts of Dynamics, namely, the doctrines of uniform and uniformly accelerated motion, of projectiles and collision.

The elements of Mechanism.

The elementary parts of Hydrostatics, namely, the pressure of elastic and inelastic fluids, specific gravities, floating bodies, and the construction and use of the more simple instruments and machines.

The elementary parts of Optics, namely, the laws of reflection and refraction of rays at plane and spherical surfaces (not including aberrations), lenses, the phenomena of vision, the eye, microscopes, and telescopes.

The elementary parts of Astronomy, so far as they are necessary for the explanation of the more simple phenomena, together with descriptions of the essential instruments of an observatory; and Nautical Astronomy.

Section E.

1. Chemistry: Questions will be set on the facts and general principles of Chemical Science. There will also be a practical Examination in the elements of analysis.
2. The experimental laws and elementary principles of Heat, Magnetism, and Electricity.
3. The elementary principles of Physical Optics according to the undulatory theory, and Acoustics, with descriptions of the fundamental experiments.

A fair knowledge of Inorganic Chemistry, or of one of the divisions 2 and 3, will enable a student to pass in this section.

Section F.

1. Comparative Anatomy and Animal Physiology: The Examination will be confined to the active and passive organs of locomotion.
2. Botany, and the elements of Vegetable Physiology.
3. Physical Geography and Geology: Explanations of Geological terms will be required, and simple questions set respecting stratified and unstratified rocks, the modes of their formation, and organic remains.

A fair knowledge of one of these three divisions, including a practical acquaintance with specimens, will enable a student to pass in this section.

Section G.

Drawing from the Flat, from Models, from Memory, and in Perspective; and Drawing of Plans, Sections, and Elevations.

Design in pen and ink, and in colour.

A fair degree of skill in free-hand drawing will be required in order that a student may pass in this section.

Questions also will be set on the history and principles of the arts of Design.

SECTION H.

The grammar of Music.

The history and principles of Musical Composition.

A knowledge of the elements of Thorough Bass will be required, in order that a student may pass in this section.

Local Committees, wishing to have Examinations held in their several districts, may obtain all necessary information from the Vice-Chancellor of the University.

Applications on behalf of Students desiring to be examined at Cambridge must be made on or before November 1, 1858.

Applications from Local Committees for examinations to be held in their districts must be made on or before October 1, and the probable number of students to be examined must be then stated. The names of such students must be sent to the Vice-Chancellor on or before November 1858, together with statements of the subjects in which they will offer themselves for examination.

The fees for all students must be paid on or before November 1, 1858.

SOUTH KENSINGTON MUSEUM.

During the week ending 10th April, 1858, the visitors have been as follows:—Morning, 9,195; Evening, 6,223. Total, 15,418.

Home Correspondence.

ALUM IN BREAD.

SIR,—Permit me to state that during the last few months I have been professionally employed to examine bread obtained from various London bakers, especially with reference to its containing alum, and that, out of some sixteen samples examined, I have in no case been able to detect the presence of more than a minute trace of alumina.

As the processes which I employed for the detection of the alum were the imperfect ones commonly in use by chemists—Kuhlmann's, for example—no doubt even the minute traces of precipitate which I obtained, and which are generally supposed to be alumina, really consisted partly, if not entirely, of phosphate of lime and phosphate of magnesia. I should certainly have determined this point definitively, by submitting the precipitates to analysis, had I obtained them in sufficient quantity.—I am, &c.

RICHARD V. TUSON, F.C.S.

Oxford-court, Cannon-street, E.C., April 15th, 1858.

MEETINGS FOR THE ENSUING WEEK.

MON. ......United Service Inst., 8½. Capt. Fishbourne, "On Floating Batteries."

TUES.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Syro-Egyptian, 7½. Anniversary.
Civil Engineers, 8. Discussion "On Hydraulic Mortar." And, if time permits, Mr. J. Brunlees, M. Inst. C.E., "Iron Viaducts over the Rivers Leven and Kent in Morecambe Bay," and Mr. R. J. Hood, M. Inst. C.E., "On Railway Stations."
Statistical, 8. Mr. Lumley, "On the Administration of the Poor Law in the Metropolis."
Pathological, 8.

WED. ......United Service Inst., 3. Dr. Bird, "On the Principles of Military and Naval Hygiene, necessary for practically improving the Sanitary Condition of British Soldiers and Sailors at home and abroad."
Royal Soc. Lit., 4. Anniversary.
London Inst., 7.
Society of Arts, 8. Mr. C. W. Siemens, "On the Progress of the Electric Telegraph."
Microscopical, 8.

THURS. ...Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Numismatic, 7.
Philological, 8.
Royal, 8½.

FRI. ....Antiquaries, 2. Anniversary.
United Service Inst., 3. Capt. Scott, "On the Topographical Survey of a small extent of Country."
Royal Inst., 8½. Col. H. James, "On the Geoditic Operations of the Ordnance Survey."

SAT.........Royal Inst., 3. Mr. E. Lankester, "On the Vegetable Kingdom in its relations to the life of man."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 9, 1858.]

Dated 6th Feb., 1858.

221. T. Waraksine, Russia—Sorting corn by its weight by means of a special machine, called "specific corn sorting machine."

Dated 11th March, 1858.

488. R. Roberts, Manchester—Imp. in mechanism for engraving and otherwise copying in line, paintings and other designs on flat and curved surfaces of metal, paper, and other materials.

Dated 13th March, 1858.

514. J. Jameson, 10, Catherine-terrace, Gateshead—Imp. in apparatus for compressing and expanding aeriform fluids.

Dated 15th March, 1858.

520. R. Edwards, 1, Single-street, Canal-road, Mile-end-road—Imp. in preparing and combining materials used in lighting or kindling fires.

Dated 18th March, 1858.

550. L. E. Fletcher, Upper Norwood—Imp. in marine engines and boilers, and their appurtenances.
552. C. Doley, Birmingham, E. Bigland and T. H. Worrall, Smethwick—Imp. in ornamenting metals.
554. Sir J. C. Anderson, Bart., Fermoy—Imp. in locomotive and other carriages.
556. T. Suffield, Bermondsey—Imp. in pumps, especially adapted for ships' purposes.
558. T. S. Sutton, Glynleiros, Neath, Glamorganshire—Imp. in miners' lamps.
560. A. V. Newton, 66, Chancery-lane—An improved process of polishing, blueing, and annealing articles of iron and steel. (A com.)
562. J. A. J. Redier, Paris—An improved chronometer, called "chronoscope."

Dated 19th March, 1858.

564. H. Brocklebank, Coventry—Imp. in chronometers, watches, and timekeepers.
566. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in the production of motive power. (A com.)
568. G. Williams and E. Rowley, West Bromwich—An imp. or imps. in piling iron.
570. J. M. May, Lambeth-hill—Imp. in fastenings for portmonnaies, travelling bags, ladies' companions, cigar, writing, and instrument cases, fusee boxes, and other like cases or receptacles. (A com.)
572. G. F. Muntz, Frenchwalls, near Birmingham—Imp. in mixing zinc with copper and other metals.
574. J. Bramwell, Buxton, Derbyshire—Imp. in apparatus for the prevention of accidents arising from the escape of gas.

Dated 20th March, 1858.

576. W. Haigh, Reddish, Lancashire—Imp. in the manufacture of a certain description of paper, and in the machinery connected therewith.
578. P. M. Parsons, Duke-street, Adelphi, and W. Dempsey, Great George-street, Westminster—Imp. in the construction of switches and crossings for railways.
580. J. Brooks, Elton, near Bury—Imp. in drawing frames used in the manufacture of cotton and other fibrous materials.
582. P. Browne, Liverpool—Imp. in the screw propeller, partly applicable to the raising of fluids.
584. W. Allen, Arthur-street, Coventry-road, Birmingham—Imp. in machinery for manufacturing screws.
586. A. V. Newton, 66, Chancery-lane—Imp. in sewing machines. (A com.)

Dated 22nd March, 1858.

590. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for exhibiting daguerreotype, photographic, and other stereoscopic views and pictures. (A com.)
591. E. J. Manwaring, Lee, Kent—Imp. applicable to stereoscopic apparatus.
592. J. Thomas, Hackney—Imp. in machinery for counting, and registering or paging.
593. C. C. Bailey, Manchester—An improved method of supplying the feed water to boilers, and in the apparatus connected therewith.
595. J. Juckes, Dame-street, Wharf-road, City-road, Islington—Imp. in apparatus for supplying coals to stoves and fireplaces.
597. I. Holden, St. Denis, and E. Hubner, Mulhouse, France—Imp. in preparing, heckling, or combing flax, silk, wool, and other fibres.
599. H. A. Jowett, Sawley, Derbyshire—Imp. in machinery for transmitting telegraphic communications and making signals, applicable to railways and other purposes.

Dated 23rd March, 1858.

600. H. L. Muller, Paris—Imp. in chromographic printing.
601. C. Atherton, H.M. Dockyard, Woolwich—Imp. in furnaces, fire grates, and stoves.
602. A. S. Stocker, 18, Wimpole-street, Cavendish-square—Imp. in the manufacture of railway axles and tubes.
603. W. Mould, Bolton—Imp. in machinery or apparatus for preparing and spinning fibrous materials.
604. J. Rowbottom and T. Standeven, Halifax—Imp. in washing, wringing, and mangling machines.
605. W. E. Wiley, 34, Great Hampton-street, Birmingham—Imp. in ever-pointed pencils.
606. C. Clifford, Inner Temple-lane—Imp. in ships' davits, and in apparatus for stowing, lowering, and securing boats.
607. E. Coulon, Croisset, near Rouen, France—Imp. in preventing the incrustation of steam boilers. (A com.)
609. W. S. Keith, York-street, Southwark—An improved rotary cutting machine.
610. C. F. Quintin, Cheltenham—A kneading machine.
611. W. Ramsell, Deptford—Imp. in furnaces and fire-places.

Dated 24th March, 1858.

612. J. C. Wilson, 11, Soley-terrace, Pentonville—An improved method for introducing elastic substances into articles of wearing apparel, and the adaptation thereof to the manufacture of certain useful garments in which elasticity is required.
613. R. Jackson, Calder-vale, Garstang—Imp. in machinery or apparatus for spinning cotton and other fibrous substances.
614. H. Gerner, 10, Newton-road, Bayswater—Imp. in apparatus for the manufacture of gas from oils or fatty or resinous matters.
615. C. Chevallier, M. I. Olivier, and E. Rolland, Brussels—A machine for making and applying as soles to shoes and boots, gutta percha, caoutchouc, and other analogous substances adapted for that purpose.
616. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in the construction of heating apparatus. (A com.)
619. C. N. Kottula, Liverpool—An imp. in the manufacture of neutral hand or skin soap.
620. A. Biddell and W. Balk, Ipswich—Imp. in steam boilers.
621. J. F. Brinjes, jun., 25, Fieldgate-street, Whitechapel, and H. J. Collins, West-hill, Wandsworth—Imp. in the manufacture and reburning of animal charcoal.
623. J. V. Hielakker, Brussels—An improved machine for compressing coal, other fuel, and substances requiring pressure.

Dated 25th March, 1858.

625. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—Imp. in the construction of railways. (A com.)
626. D. A. Hopkins, Paterson, U.S.—Imp. in journal boxes.
627. W. Crook, Blackburn—Imp. in looms.
628. J. Nuttall, Walmersley, near Bury—Imp in looms.
629. G. H. Ellis, New Malton, Yorkshire—Imp. in kitchen ranges.
630. W. E. Newton, 66, Chancery-lane—Imp in the means of and lamps for burning certain kinds of oil and hydro-carbons. (A com.)
631. F. Haeck, 14, Place de la Reine, Brussels—Imp. in pumps for pumping beer, wine, vinegar, oils, or other liquids, containing acids or oily matters. (A com.)
632. F. Foucou, 44, Rue Caumartin, Paris—Imp. in steam boiler and other furnaces.
633. W. Richards, Birmingham—Imp. in breech-loading guns and fire-arms.
635. W. Robjohn, Stanhope-street, Hampstead-road—Certain imp. in organs.
636. F. A. Chevallier, Paris—Imp. in photographic apparatus.

Dated 26th March, 1858.

637. R. A. Brooman, 166, Fleet-street—Imp. in weighing machines. (A com.)
639. P. H. G. Bérard, 323, Rue St. Denis, Paris—Applying concentrated collodion to the effect of superseding caoutchouc in waterproofing stuffs of all descriptions for manufacturing garments and wearing articles, and also for applying it over painted surfaces instead of varnish.
641. J. Horton, Smethwick—An imp. or imps. in the construction of the girders used in the guide framing of gas holders.
643. H. Doulton, Lambeth—An imp. in the manufacture of invert blocks used in constructing sewers and drains.
645. W. E. Newton, 66, Chancery-lane—An improved machine for performing the addition of numbers, quantities, or sums of money, to be termed the "arithmometer."

Dated 27th March, 1858.

647. J. Newman and J. F. Newman, 122, Regent-street—Imp. in spectacles.
649. E. C. Jones, Caroline-street, Bedford-square—Imp. in railway brakes.
651. B. Burrows, Leicester—Imp. in weaving webs or narrow goods, and in ornamenting elastic webs.
653. J. Welch, Southall—Imp. in portable railways, and in the means of their application to carriages to facilitate their movements on common roads and other surfaces.
655. W. A. Gilbee, 4, South-street, Finsbury—Imp. in treating saccharine fluids. (A com.)

Dated 29th March, 1858.

657. W. A. Gilbee, 4, South-street, Finsbury—Imp. in treating brandies and other spirituous liquids for improving their quality. (A com.)
659. J. R. Breckon, Darlington, and R. Dixon, Crook, Durham—Imp. in the construction of coke ovens.
661. J. F. Spencer, 1, Adelaide-place, London-bridge—Imp. in marine engines.
663. J. Baillie, 167, Carolinen Gasse, Vienna—An improved construction of coiled spring.
665. I. Brown, Carlisle, and J. Brown, Notting-hill—Imp. in the manufacture or production of manure.
667. E. A. Jacquin, Rue des Lavandières, Ste. Opportune, Paris—An imp. in preparing plates for printing. (A com.)
669. W. Harding, Forest hill, Kent—Imp. in revolver fire-arms, and in apparatus for manufacturing projectiles.

Dated 30th March, 1858.

671. J. C. Durand, Pimlico—Imp. in the manufacture of iron.
673. T. Silver, Philadelphia, U.S.—Pulsating valves or governors.
675. B. Wood, Huddersfield—Imp. in machinery or apparatus for cleansing the waste of woollen or other fibrous manufactures.
677. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of sheet iron. (A com.)

Dated 31st March, 1858.

679. F. A. Gatty, Accrington—Imp. in treating certain compounds containing the colouring matter of madder.
681. M. B. Westhead and H. Baines, Manchester—Certain improved apparatus for coupling or connecting carriages, wagons, trucks, vans, and engines used or employed upon railways.
683. E. H. Todé, Peckham—Imp. in apparatus for generating steam in steam boilers by means of gas.
685. B. W. Croker, Vienna—Imp. in axle boxes to render themself lubricating.
687. F. Edwards, Hillfields, and W. Edwards, Howard-street, Coventry—Imp. in weaving.
689. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in articles of buoyancy, to be used either for swimming or for the saving of life from drowning. (A com.)
691. R. Barr, Glasgow—Imp. in machinery or apparatus for making rivets, spikes, nails, and screw blanks, and similar articles in metal.

WEEKLY LIST OF PATENTS SEALED.

April 9th.

2589. J. Harland.
2598. G. F. Lombard.
2599. A. Barlow.
2601. R. Porter.
2605. F. Prestage.
2607. G. Beard.
2609. W. Calvert.
2671. M. Henry.
2677. D. Patridge.
2685. I. Storey and J. H. Storey.
2713. C. de Clippèle.

April 13th.

2612. W. Brookes.
2617. J. H. Simpson.
2625. J. F. Swinburn.
2629. J. Middleton and W. Rylance.
2630. T. Restell.
2631. J. Parker.
2632. J. C. Plomley.
2634. E. Wilkins.
2637. R. G. Balderston.
2641. H. A. L. Negretti and J. W. Zambra.
2642. J. Gibbs.
2643. P. Heilmann.
2646. G. Scarr and J. Pollard.
2651. J. Bernard.
2656. R. J. Badge.
2683. J. H. Johnson.
2690. C. Reeves.
2751. J. Craven.
2762. T. S. Prideaux.
2921. H. Bessemer.
2978. J. Howard.
3000. R. Hazard.
3053. S. Biggin and J. Biggin.
3156. C. Reeves.
130. J. Craven, W. Hey, and C. Worsnop.
133. J. J. Huber.
272. A. V. Newton.
288. W. Cope.
299. C. Monson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

April 6th.

789. J. H. Johnson.
801. S. Holt.
805. J. L. Norton.

April 8th.

784. W. Ricketts and T. Bulley.
802. G. F. Wilson, C. A. Hanson, and J. J. Wallis.

April 10th.

785. S. Fielding.
819. T. Wimpenny and J. Wimpenny.
823. G. Turner.
835. E. H. Bentall.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4074	April 8.	Improved Curved Tooth-Brush	W. Herring	121, St. John-street, West Smithfield.
4075	,, 9.	Photographic Portable Dark Operating Chamber	W. W. Rouch	180, Strand.
4076	,, 9.	A Marine Course and Distance Indicator	H. Bridson C. C. Pole	Bolton-le-Moors, Lancashire. Temple, London.
4077	,, 12.	A Combined Needle Case	A. Turley	New-street, Worcester.

Journal of the Society of Arts.

FRIDAY, APRIL 23, 1858.

THE LATE MR. R. HORSMAN SOLLY.

The Secretary has received a communication from the Executors of the late Mr. Solly, to the effect that he has bequeathed to the Society the sum of One Hundred Pounds.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present session; the first on Saturday next, the 24th April, at the Society's House, the card for which will admit the member only; the second on Saturday, the 8th May, at the South Kensington Museum, the card for which will admit the member and two friends, ladies or gentlemen. The cards for each of these evenings have been issued.

Members of Institutions in Union who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 5th instant.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members, by ticket, or written order bearing their signature, may admit any number of persons. The number of visitors up to yesterday, the 22nd inst., was 2,702.

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty Local Boards have been formed. Returns of the Candidates who have passed the Previous Examination have been received up to the 22nd inst., as follows:—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	83
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No. 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	18
Halifax, No. 1.	15
Salisbury	1
Sheffield	18
Liverpool	35
Lockwood	1
Halifax (Working Men's College), No. 2.	21
York	7
Berkhampstead	19
Bristol	11
London Domestic Mission	1
Royal Polytechnic Institution	28
Birmingham, No. 1, Messrs. Chance's Reading Room	2
Sheerness	1

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

	£	s.
T. D. Acland, Member of Council	£ 5	5
The Rt. Hon. C. B. Adderley, M.P.	5	0
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	£ 2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P.	10	10
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

NINETEENTH ORDINARY MEETING.

Wednesday, April 21, 1858.

The Nineteenth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 21st inst., W. R. Grove, Esq., Q.C., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Beale, Lionel S., M.D.	Salisbury, the Marquis of, K.G.
Davies, George	Todé, Edward Henri
Gifford, William J.	Webster, James Porter
Loxley, John	Winder, Thos. Robt., C.E.
Maguire, John Fras., M.P.	

The following Institution has been taken into Union since the last announcement:—

St. Bartholomew's Working Men's Literary Institute.

The Paper read was—

ON THE PROGRESS OF THE ELECTRIC TELEGRAPH.

By C. W. Siemens, C.E.

The growing importance of the electric telegraph, both in a scientific and social point of view, and the circumstance of my connection for a good many years with its practical development, are the apologies I have to make for venturing to occupy the attention of the Society this evening.

The object which I have more particularly in view is to trace the gradual course of progress of this invention since the time of its first appearance upon the stage, without pretending indeed to establish any new historical facts or to decide upon the relative merits of contending claimants to invention or discovery, (although I shall not willingly offend against the right of anyone), but with a view to establish more clearly our present position in the scale of progression, and to point out with some degree of certainty the direction in which we should travel in order to realise still greater results, particularly the accomplishment of transoceanic communication.

When, little more than a century ago, Franklin, the father of electrical science, ascertained that atmospheric electricity, which manifested itself in the imposing form of thunder and lightning, was identical with frictional electricity, he employed an apparatus comprising an insulated metallic conductor, the electric machine, the earth return circuit, and a receiving instrument, consisting of a pair of cork balls, suspended by silk threads, which, upon being electrified, struck against a pair of signal bells. This apparatus comprised, indeed, all the elements required for the construction of a modern electric telegraph. Nor was the idea of an electric telegraph new, even in the days of Franklin, for we are informed that as early as the year 1728, a pensioner of the Charter House, named Stephen Grey, made electrical signals through a suspended wire, 765 feet long. Yet a century of unceasing efforts, by men of all civilised nations, including some of the greatest natural philosophers the world ever produced, was still required to reduce those elements into available forms for practical purposes.

If we pass over the experiments by Winkler, of Leipzig, in 1746, Watson, of London, and Le Monier, of Paris, in the year following, as preliminary inquiries into the velocity of the electric current in metallic conductors, we find that the honour of having produced the first electric telegraph is due to Lesage, of Geneva, who actually constructed, in 1774, an experimental line of communication, consisting of 24 suspended line wires, representing the 24 letters of the alphabet respectively. Each wire terminated in a pith ball electrometer, the balls of which separated, upon the wire in question being charged at the other extremity by means of a Leyden jar, denoting the letter intended to be communicated. Lomond, of France, perceiving the difficulty and expense attending so many line wires, contrived, in 1787 (see "Young's Travels in France," 1787), an experimental line of telegraph in his house, consisting of only one line wire connected with a pith ball electrometer at both ends, and he proposed a telegraphic code by repetitions of his only primitive signals. Reisser, Dr. Salvo, of Madrid, and many others proposed various modifications of the same apparatus, but it is hardly necessary to add that all of them remained unrewarded by success.

In consequence of so many fruitless attempts, electric telegraphs were already being classed among the chimerical projects of the time when at the dawn of the present century a new field for invention was opened by the important discoveries of the Italian philosophers, Galvani and Volta.

The voltaic current, unlike the spontaneous discharge of static electricity, could be conducted with comparative facility through long metallic conductors, and was capable of very powerful effects in decomposing water or other substances, which qualities rendered it clearly preferable for telegraphic purposes.

Struck by these views, Soemmering, of Munich, constructed, in 1808, the first voltaic telegraph, consisting of 35 line wires, any two of which could be combined to form the electric circuit and produce a signal at the other extremity by decomposition of water under any two of 35 inverted glass cups, arranged side by side in an oblong bath of acidulated water. The 35 wires terminated in gold points, under the inverted glass cups (or voltameters), and the rising of the gases of decomposition betrayed to the attentive observer the passage of the current.

The difficulty of dealing with so many wires suggested to the mind of Schweigger the same expedient which Lomond had recourse to with regard to static electricity, that of reducing the number of line wires to a single metallic circuit, and the receiving instrument to a single decomposing cell, having recourse to repetition, and to differences in the duration of succeeding currents, in arranging his telegraphic code.

It seems not improbable that if electrical science had made no further advances, the projects of Soemmering and Schweigger would have gradually expanded into practically working chemical electric telegraphs, such as have been proposed at a much later period by E. Davy, 1838, Morse, 1838, Bain, 1843, and Bakewell in 1848, which latter is particularly interesting inasmuch as not mere signals or conventional marks are received by it, but a fac-simile of the message, previously written with a solution of shellac upon a metallic surface.

The discovery of Oersted, in 1821, which, under the hands of Schweigger, Ampère, Arago, and Sturgeon, soon expanded into electro-magnetism, turned the tide of invention into quite another direction. Ampère was the first to propose an electro-magnetic needle telegraph, consisting of 24 needles, representing each a letter of the alphabet, and 25 line wires, the extra wire being intended for the metallic return circuit common to all. Ritchie executed, in 1832, a model of Ampère's telegraph, with an essential improvement, to the effect that each needle, by its motion, moved a screen disclosing a letter of the alphabet.

Another version of the same general arrangement was patented by Alexander, of Edinburgh, as late as 1837. Fechner, of Leipsig, and Schilling von Canstadt, of Russia, proposed, in 1832, apparently independently of each other, a single-needle telegraph, with deflection of the needle to the right and left; and Fechner was the first to prove, by calculation, the power of the galvanic current to traverse a great length of line wire.

Gauss and Weber, of Goettingen, took up the subject of electric telegraphs at about the same time, but had not proceeded far when their attention was diverted by the great crowning discovery in electrical science, I mean the discovery of induction and of magneto-electric currents by Faraday, in 1831.

Gauss and Weber rightly judged the superiority of magneto-electric over voltaic currents for telegraphic purposes, and in applying them they effectually established the first working electric telegraph in 1833, with the ar-

rangements of which I became practically acquainted some years later, when a student at Goettingen.

It consisted of a line wire and return current wire, the former of which was carried upon high posts over the town of Goettingen, extending from the observatory to the tower of the public library, and thence to the new magnetic observatory of Weber, a distance of little more than an English mile. The magneto-electric current was produced by means of a coil containing 3,500 turns, which was situated upon a compound bar magnet, weighing 75 lbs., the coil being at liberty to slide freely to and fro upon the bar. In sliding the coil rapidly from the centre toward the south pole of the magnet and back again, a succession of two opposite currents was produced, which, traversing the line-wire circuit, including coils of the receiving instrument, caused a short jerk of the needle, say to the right and back again, whereas the deflection of the needle would be to the left when the exciting coil was moved towards the north pole and back. The amount of motion imparted to the coil determined also the amount of deflection of the needle, and could, by means of a telescope and a scale, be read off in degrees on a reflector attached to the end of the needle. The needle itself weighed 100 lbs., and was suspended from the ceiling of the room by untwisted silk. Notwithstanding the extraordinary weight of the needle, (which was the same as that used by Gauss to determine the laws of terrestrial magnetism) its motions were beautifully energetic and distinct when viewed through the telescope. Gauss and Weber did not pretend, however, to the construction of a commercially useful electric telegraph, but delegated that task to Steinheil, of Munich, who enjoyed already at that time a reputation as a skilful mechanic. Steinheil applied himself vigorously to the task, and produced, in 1837, his needle printing and acoustic instruments, which he first tried at Munich through about 5 miles of suspended line wire and shortly afterwards upon the Taunus Railway, near Frankfort. In trying whether the rails might not be used for metallic conductors, he re-discovered the conducting power of the earth itself, which, it appears, had been lost sight of since it had first been discovered by Franklin with regard to static electricity, and proved also with regard to Voltaic electricity, in 1803, by Erman, Basse, and Aldini.

The first recording instrument, and the telegraphic earth circuit, are discoveries which entitle Steinheil to a high position among the originators of the electric telegraph, although the means he proposed for its execution were too refined for the time, and did not lead on that account to immediate practical results.

At the time when Steinheil was absorbed in his labour, Professor Wheatstone was also engaged upon a series of experiments on the velocity of electricity, with a view to the construction of electric telegraphs, and in June, 1837, he joined Mr. Cooke in a patent for a needle telegraph of five line wires (besides one wire for the return current), and as many needles, which, by an ingenious system of permutations, could be so deflected that any letter of the alphabet was pointed out upon a diamond-shaped board by the convergence of two needles towards it. The line wires were proposed to be coated with insulating material, such as fibrous substances saturated with pitch, and to be drawn into leaden pipes, in order to exclude the moisture of the ground into which they were intended to be laid. An experimental line of telegraph on this principle was established in the same year, at the Euston Railway Station, and the results obtained left, it appears from documentary evidence, no doubt upon the mind of the then resident engineer of the London and Birmingham Company, the present Sir Charles Fox, of its ultimate success. That success, however was not obtained without a struggle against practical difficulties, in the course of which the system underwent important modifications, of which the double needle instrument, such as is still used extensively in this country, and (in 1843) a return to overground line wires, were the results.

To Cooke and Wheatstone is due the credit of having established the first commercially useful lines of electric telegraph, namely, the lines between Paddington and Drayton, commenced in 1838, and between London and Blackwall, commenced in December 1839, which were soon followed by others.

If viewed from our present position, the needle telegraph cannot be considered an advance, in point of principle, on Gauss and Weber, or Steinheil: it involved, in fact, a return from magneto-electric to Voltaic currents—from a single-line wire to several—and from recording of messages, to their mere indication; yet, for the time being, when insulation was imperfect, and the important law of Ohm was hardly understood, except by a few natural philosophers, it had the probability of success in its favour, because the duty required from the electric current consisted in deflecting a magnetic needle to a merely appreciable extent, and it was of no great importance to the result whether a more or less considerable proportion of the current was lost through imperfect insulation. The upright weighted needle—the key with dry metallic contacts—and other details, were also of a novel and meritorious character. Why the same system should however be still persisted in at the present day, in this country, when improved systems have been adopted in nearly all other countries, including the British possessions, is a question which, I hope, will receive an answer from those who practically uphold it. It is evident, however, that Wheatstone did not intend to stop there, from his numerous other inventions, which followed each other in rapid succession, and amongst which his dial and printing instruments—his early applications of magneto-electric currents—the relay—and the first judicious application of electro-magnets, so as to obtain more powerful effects at distant stations, are the most remarkable.

The country of Franklin has not been behindhand in gathering the first fruits of electrical science. It is said that Morse contemplated the construction of an electric telegraph since the year 1832, although he did not take any overt step till the year 1837, when he lodged a caveat in the American Patent Office, which patent was not enrolled till the year 1840. There is no evidence to show that Morse's early ideas had assumed any definite shape until the year 1838, when he deposited an instrument of his construction at the Paris Academy of Sciences. Morse's invention consists chiefly in the substitution of electro magnets for needles in the construction of a recording instrument, which, in other respects, is similar to Steinheil's. The step was, however, an important one to render the instrument powerful and certain in its action, and, combined with Wheatstone's relay, Morse's recording instrument will, it may be safely affirmed, be used universally for all except local telegraphic communication.

In the year 1845, when the practical utility of electric telegraphs had been demonstrated in England, several continental governments determined upon their establishment. The Belgian, Austrian, and, a few years later, the Sardinian government, simply adopted the double needle telegraph. In France, Messrs. De Foy and Breguet, fils, contrived a double step by step or dial telegraph on Wheatstone's principle, which enabled them to imitate the same code of signals which had been used for the Semaphore telegraph.

In Prussia a royal commission was appointed to consider and advise upon the system to be adopted, of which commission my brother, Werner Siemens, who had been engaged before with kindred subjects, became the most active member. The commission was in favour of an underground system, and charged Werner Siemens to institute experiments. About this time gutta percha had become known in this country, and having been struck with its peculiar plasticity, I forwarded my brother a sample, to see whether he could use it for the purposes he had in view. He soon discovered its remarkable insulating properties, and recommended an experi-

ment on a large scale, which having been sanctioned, he completed a line of from four to five English miles (between Berlin and Gross-Beeren) successfully in the summer of 1847. The machine he designed for covering the copper wire with gutta percha is nearly identical with the cylinder machine still used for the same purpose. In the spring of 1848, a considerable length of gutta percha coated copper wire was submerged in the harbour of Kiel for military purposes, but it was found that, owing propably to the impurity of the material, the gutta percha underwent a gradual change, as though it was penetrated by the sea-water, to counteract which Werner Siemens proposed, with apparent effect, to mix a small proportion of sulphur with that substance. In the same and following year more than a thousand miles of gutta percha coated line wire was laid down underground, and proved successful for several years, when it began to fail, for the most part, in consequence of the impure and adulterated condition of the material then supplied. Although the underground line wire has, for the most part, been superseded again by the suspended wire, I venture to assert that we shall eventually return to it for all principal lines, for reasons which I shall enumerate hereafter. The experience gained in this great experiment has been most valuable in paving the way to submarine cables, which, at the present time, occupy so large a share of public attention.

The instruments which Werner Siemens at first proposed, and which are still used extensively on the continent for railway purposes and town service were dial instruments, involving a peculiar principle, inasmuch as no communicating instrument or any clockwork is employed, but the two or more instruments, connected by the single line wire, break and restore the electric circuit by the action of their own armatures, in a similar way to a steam engine, which alternately intercepts and restores the communication with the boiler. In arresting the ratchet wheel of any one of the instruments within the circuit, by depression of a key, bearing a certain letter of the alphabet, the armature of the instrument in question is prevented from restoring the electric circuit, and the hands upon the dials of all the instruments in circuit must stop, pointing all of them to the same letter, until the depressed key is again released. The advantages of this arrangement over previous dial instruments are that the communicating instruments are less liable to fall out of step, and that considerable power of action is obtained, because the batteries of all the intermediate and end stations act in concert, being all included in the general circuit. The dial instrument is in some instances accompanied by a type printing instrument, differing from Wheatstone's and House's arrangements, inasmuch as it is entirely self-acting, the motion of the type wheel, of the paper, and even of the hammer striking the blow upon the type, being effected by electro magnets instead of clockwork, or of an air cylinder, as is the case in House and Brett's arrangement.

Since the time of the first successful introduction of the electric telegraph, a great variety of instruments, insulators, and other appliances, have been proposed, amongst which the chemical recording instruments of Bain and Bakewell, the modifications of Wheatstone's magneto-electric needle, and dial instruments by Henley and Stoehrer, the various combinations by Messrs. Highton, Clark, and Bright, and the more recent productions of Mr. Varley and Mr. Whitehouse, are of undoubted merit in having contributed to the general progress of electric telegraph engineering. To describe them here would be a task far exceeding the limits of this paper, and I shall therefore proceed at once to point out what, in my opinion at least, supported by actual experience, are the best means to be adopted, at the present time, for extending the electric telegraph, both on land and across the seas.

The foregoing sketch of the gradual development of the electric telegraph, may serve to show that the particular arrangements adopted to indicate or register the message, or the particular combination of elementary signs, is of secondary importance, but that every essential progress is marked by the discovery of some new means of generating currents of greater dynamic power, or of producing by their means more decided effects at the further extremity of the conductor.

Let us inquire, then, what are the conditions of current generator, current conductor and receiver, best calculated to realise a maximum of palpable effect at great distances.

Inquiry into these questions is of particular interest at the present time, when great efforts are being made to extend telegraphic communication across the Atlantic and Indian oceans, distances far exceeding the length of any land lines yet constructed.

Among the different varieties of electricity hitherto applied to telegraphic purposes, that produced by friction possesses the greatest tension or power to overcome resistance in the conductor. But its discharge is instantaneous, and it is, therefore, ill-suited to produce dynamic effects with time or duration for a factor.

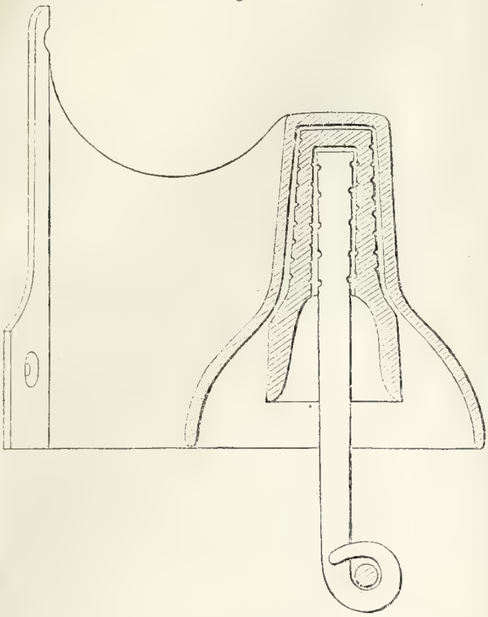
The Voltaic current, on the contrary, may be considered as absolutely continuous, and, therefore, as best suited to produce powerful effects, but it is deficient in tension, unless a great number of elements are employed, in which case it becomes expensive and troublesome. A battery of sufficient intensity to convey an effect through the Atlantic cable, would have to be composed of at least 500 Daniell's cells, according to ordinary practice, but I apprehend that the internal resistance of such a battery would of itself annihilate its presumed power, and that practically no battery of sufficient power could be thus constructed.

The magneto-electric currents hold an intermediate position between the two just referred to. Their intensity can be increased almost indefinitely, and they are of a perceptible duration (the time required to charge an electro magnet). They may be produced by mechanical agency, on separating a permanent magnet from its armature or surrounding coils, or by means of a voltaic quantity battery and primary coils; and are, in both instances, by far the cheapest and least variable description of electric currents. The reason why, since the discovery of magneto-electricity in 1831, it has again and again been abandoned in favour of battery currents, may be traced to the imperfect means hitherto known or adopted for its generation or suitable application; but I hope to prove hereafter that it can be employed at present with perfect success.

Regarding the electric conductor or line-wire, this is either suspended upon poles in the open air, or it is imbedded in gutta percha, and interred or submerged. Suspended line-wire generally consists of galvanised or painted iron, of from one-eighth to one-fifth of an inch in diameter, and supported, at intervals of from 50 to 60 yards, from posts by means of insulators. The construction of a really efficient insulator has for many years occupied the serious attention of electrical engineers, for upon it chiefly depends the permanent efficiency of the line. A great variety of insulators have been tried, some of which I am enabled, by the kindness of the Electric Telegraph Company, to present to the meeting. According to continental experience, the insulator of Siemens and Halske (Fig. 1), has been found to combine the desiderata of strength and insulating property in the highest degree. It consists of a cast-iron bracket, assuming the form of an inverted bell, with a cylindrical recess at the bottom. A capsule of porcelain is firmly cemented, by means of sulphur mixed with caput mortuum, into the recess, and into this again a stalk of iron is cemented, which, forming a peculiarly twisted loop at the end, supports and secures the line-wire. The insulating property depends upon the dryness of an apron-like extension of the porcelain capsule, which, under the protection of the cast-

iron ball, is not affected by either rain or dew. Every tenth support is a stretching-post insulator, at which the

Fig. 1.



INSULATOR.

line-wire is not only supported but held firmly by means of claws, an arrangement which has been found very convenient during the erection of the line-wire, and in case of repairs. An idea of the importance of a good insulator may be formed from the fact, that the cost of finding and repairing a single defect of the line-wire, in a country like Russia, amounts on the average to £30.

We now approach the subject of submerged conductors, which, at the present time, engrosses the attention of electrical engineers, and also commands a large share of public interest, owing both to the difficulties with which it is surrounded, and the vast importance of the object in view.

Regarding the history of submarine cables, it appears that the first experiments, on a small scale, to submerge an insulated conductor (copper wire coated with cotton thread saturated with pitch and tar) were made at Calcutta, in 1839, by Dr. (now Sir) William O'Shaughnessy.

Professor Wheatstone proposed, in the following year, to establish a telegraph cable between England and France, and prepared very elaborate and well-considered plans, which, by his kindness, I am enabled to place before the meeting. The cable Wheatstone proposed contained 6 separately insulated copper wires which were protected by a strong sheathing of iron, differing, however, from the sheathing now generally adopted, in being devoid of strength in a longitudinal direction.

Submarine telegraphs must, however, have proved impracticable but for the timely discovery of gutta percha, and of its remarkable insulating properties. It is, therefore, not suprising that the first successful attempts to establish sub-aqueous conductors were made by Werner Siemens, in 1848, in the bay of Kiel, and in crossing the Rhine at Cologne, and other rivers.

The gutta percha coated copper wire was at first submerged without outer protection, but it was laid by the side of a strong chain to protect it from anchors. In the following year, however, a lead coating was introduced.

The first attempt to establish a sub-aqueous conductor across the open sea (from Dover to Calais) was made by Wollastone, in 1850. It consisted of a gutta percha coated copper wire, without external protection, and failed immediately after it had been laid. In the following year, Crampton laid a cable between the same places successfully. This cable was sheathed with iron wire, according to Messrs. Newall and Co's. patent process, which gives great longitudinal strength, and has been generally adopted ever since, except in the instance of the Varna-Balaclava cable (laid by Messrs. Newall and Co. in 1854), which had no sheathing, excepting at the shore ends, and which worked successfully till just before the evacuation of the Crimea by the allies.

It would be tedious to notice the numerous successful and unsuccessful attempts which have been made since the year 1837, to establish submarine cables, suffice it to state the general results of the experience obtained, which goes to prove that the difficulty of submerging and working submarine cables is small in shallow and narrow waters, but increases in a very rapid ratio with the depth and breadth of the ocean to be traversed.

An inquiry into this most interesting subject may be divided into three sufficiently distinct heads, namely, the mechanical problem of constructing and submerging the cable; the electric condition of the submerged cable; and, lastly, the question of suitable instruments.

The mechanical problem has been discussed lately at great length at the Institution of Civil Engineers, I therefore propose to limit myself to a recital of the principal points of interest which may be considered as established both by theory and in practice.

The cable should be of small specific weight and of great tensile strength, in order that its descent through the water may be retarded by the resisting medium to such a degree that the velocity of maximum acceleration may not exceed one-fourth, or at most one-third, of the velocity of the vessel. This condition of a "balanced cable" being fulfilled, there remains the tendency of the cable to slide down the inclined trough of the water, and it has been proved that this force equals, under all circumstances, the weight of a length of cable (less the weight of water it displaces) reaching from the vessel perpendicularly to the bottom of the sea. The same amount of retarding force must at least be applied to the paying-out brake, to prevent great waste of cable, and the cable itself must of course be sufficiently strong to bear this strain without injury to the insulated wire or wires.

Messrs. Longridge and Brooks have been the first to prove, I believe, that currents in the ocean cannot sensibly augment the strain upon a descending cable, nor are they likely to occasion considerable loss.

It has been proposed to increase the floating power of deep-sea cables, by attaching floats at intervals; but it appears to me that such appliances, which depend upon the unerring dexterity of workmen at the moment of danger, and which moreover do not relieve the cable from retarding strain at the brake, should be discarded, and the cable be made to possess in itself all the requisite degree of buoyancy and strength. For this purpose, the conducting wire or wires should be as light as possible consistent with good conducting power, a combination of properties which seems to point to the newly discovered metal, aluminium, as likely ultimately to supersede copper. The insulated covering of gutta percha increases the bulk without adding to the weight of the cable, being nearly of the same specific gravity as sea water, it improves both the mechanical and electrical properties of the cable, and the only limit to its desirable thickness is its expense. The principal weight, and all the available strength of the cable, reside in its sheathing, which should be made of a material combining strength with lightness, and also with hardness, to resist the the crushing and tearing action of the brake-wheel; and there can be no doubt that steel wire combines these qualities in the highest degree, nor do I think it would be much dearer than iron if power of suspension was taken for the basis of calculation.

It can easily be shown, by the simple rule given above,

regarding the strain upon the cable in leaving the vessel, that an iron-sheathed cable cannot, under the most favourable circumstances, be laid in water of more than three miles in depth, without a certainty of rupture taking place, whereas a steel-covered cable might be laid, with reasonable safety, to a depth of five or six miles, which depth is, I believe, rarely exceeded in any ocean.

Respecting the paying-out machinery, I have to notice Messrs. Newall and Co.'s apparatus, consisting of a solid centre, and heavy rings to form a double cone for guiding the cable safely out of the hold, and the brake, which latter should be made as light as possible, to avoid jerks upon the cable, and should indicate the variable strain put upon it, to harmonise its speed with that of the vessel.

In order to insure continuity of the electric conductor in a cable, a strand of several copper wires is now generally adopted, instead of a single wire, which latter is found to be very liable to break. This simple but useful plan was, I believe, first thought of and acted upon by myself, having ordered some gutta percha coated strand, for experiment, from the Gutta Percha Company, in the spring of 1855, part of which I have laid upon the table.

The electrical condition of the submerged conductor is a subject of the greatest interest, upon which electricians are still divided, and which, treated mathematically, involves problems of the highest order, such as only Professor William Thomson and a few others can hope to deal with effectually. The important point is, however, to arrive, first of all, at a clear understanding of the laws of nature upon which those calculations should be based, and those laws, when rightly interpreted, are always extremely simple.

The submerged (or underground) line wire may in the first place be considered in the light of a mere conductor, following Ohm's law, which, as is well known, is to the effect that the amount of electricity passing in a given time depends upon the sectional area of the conductor, upon the electric force (intensity) of the battery, upon the specific conducting power of the material, and inversely upon the length of the conductor. It is expressed by the following formula:—

1. $$P = \frac{E\,a\,c}{l}$$ in which

P, signifies the quantity of electricity passing;
E, the electric force of the battery, or its substitute;
a, the sectional area of the conductor;
c, the specific conducting power; and,
l, the length of the conductor.

In the next place, the cable has to be considered in the light of a Leyden jar of extraordinary length, formed of gutta percha, with the conductor for an inner, and the sheathing (or moisture) for an outer metallic coating. This Leyden arrangement has to be charged to a certain degree before the electric current can make itself felt at the further extremity, but the supply of electricity being limited at every point by the resistance offered by the conductor, according to Ohm's law, it follows that the entire cable can be charged only in a progressive manner, as though it consisted of a series of Leyden jars charging the one into the other until it reaches the last, which discharges itself through the receiving instrument into the earth. The amount of impediment thus offered to the progress of the electric current depends evidently upon the capacity of the Leyden arrangement, which capacity should be reduced to a minimum for a given size of conductor.

According to Faraday's definition of dio-electrics, the electric charge obeys the same simple law, which regulates the dispersion of heat in an imperfect conductor, and which, again, is analagous to Ohm's law regarding electric currents. It follows that the electric charge of a Leyden arrangement is directly proportionate to the lining surfaces—directly to the electric force of the battery (or its substitute) employed, and to the specific inductive capacity of the insulating medium, but inversely proportionate to the thickness of insulating coating; or, if expressed by a formula, we have:—

2. $$Q = \frac{E\,S\,k}{d}$$ in which

Q, expresses the electric charge;
E, the electric force of the battery;
S, the metallic surface;
k, the specific inductive capacity; and,
d, the thickness of coating.

This formula is corroborated by a series of very careful experiments by Werner Siemens upon electric cables, and it is of great practical utility if combined with Ohm's formula regarding the conductor.

The following are some of the simple consequences derived from the two formulæ:—

1. The electric force (E) of the battery (and its substitute) has no influence upon the onward velocity of the electric wave, because it increases the value of P and Q equally.

2. The time $\left(t = \frac{Q}{P}\right)$ required to charge a submerged conductor of a given proportion increases in the square ratio of the length (l) of the conductor—(in the formula for Q, the factor (S) has to be expressed by l and a)—which law was first arrived at by William Thomson in another way, and was communicated by him to the British Association in 1855, but has since been assailed by Whitehouse and other electricians.

3. It is of the first importance to make the conductor of the best conducting material, and the insulating coating of the greatest practical thickness, but of a material with the least specific conductive capacity.

4. Given the materials and the thickness of the insulating coating, the rapidity of progress of the electric wave increases in the simple ratio of the diameter of the conductor; a proposition differing also from the views of the promoters of the Atlantic cable, who assert that the maximum result is obtained by a conductor of comparatively small diameter.

The results obtained by means of these formulæ are, however, modified by disturbing causes, which have to be taken into account by the electrical engineer. Among these, the conducting power of the gutta percha itself is the most important. It appears, from certain experiments made at Birkenhead by Messrs. Newall and Co., upon one-half of the Atlantic cable, that when the entire cable is formed into an electric circuit, only about one-third part of the current will follow the wire throughout its length, and the remaining two-thirds will pass through the gutta-percha covering to the earth. The relative amount of leakage through the covering increases in an extraordinarily rapid ratio with an increase of temperatnre; and it must be deemed a most fortunate circumstance that the temperature of the great oceans is probably not above 40 Fahr. at the bottom, being the temperature of maximum density of water. Messrs. Buff and Beete have found that glass also becomes conductive of electricity when but moderately heated; and they attribute the effect to electrolysis, or decomposition of the alkali it contains. In the case of gutta percha, it arises possibly from decomposition of the water of hydration or of some vegetable constituent of that substance. A careful experimental inquiry into this question, including some other deteriorating effects upon gutta percha, would be of great practical importance; and it is to be hoped that the Gutta Percha Committee, lately appointed by this Society, will furnish some valuable information.

The effect of leakage through the coating is retardation, in the direct proportion of the surface of the conductor, and the inverse ratio of the thickness of the coating; but the co-efficient varies according to the temperature and quality of the material. There are some other disturbing causes, of comparatively less importance, namely, voltaic induction and magnetisation

of the iron sheathing by the line-wire current. The voltaic induction, or tendency of one current to produce a current in the opposite direction in another conductor parallel to itself, is of importance only in the case of compound cables, and may even be turned to advantage, if the return current is laid through one of the parallel wires instead of the earth. By the same expedient, magnetisation of the sheathing, which is necessarily a retarding cause, and is, moreover, productive of a disturbing extra-current, may be neutralised.

In calculating the time required for an electric current to traverse a cable of given length and proportion, it may be received as an experimental datum to start from, that it reached the distance of 1,000 miles in one second, in a cable consisting of No. 16 copper wire coated with gutta percha to the thickness of $\frac{5}{16}$ths of its diameter, a proportion most generally adopted. The discharge of the same cable would occupy practically about two seconds, and these times go on increasing in the ratio of the square of the length of conductor, in as far as the retardation by electric charge is concerned, and in the simple proportion of losses by leakage, voltaic induction, and magnetisation, the result being a mean between the two ratios.

With these facts before us, it would have been impossible to work an electric telegraph across the Atlantic or Indian oceans with anything approaching a commercial result; and the idea must have been abandoned, but for Faraday's timely discovery that several electric waves may co-exist, following each other, in a long cable, whereby the number of impulses to be transmitted in a given time may be greatly increased.

A difficulty experienced in carrying this method of working into effect, is the partial merging of the separate waves into an almost uniform electric charge of the conductor, which causes the receiving instrument to be permanently affected. This difficulty has however been removed by a return to Gauss and Weber's method of working, in sending always two opposite currents in succession, whereby not only the effective value of each wave is doubled, but accumulation of electric charge is entirely prevented, because the two opposite waves, in emerging, destroy each other. This method of working would, however, not be complete without a return also to the same description of current which Gauss and Weber employed. It has, indeed, been shown above, that currents of high electric force do not travel any faster through submerged conductors than feeble currents, but the advantages of the former are, that each electric wave represents a larger accumulation of force, and travels consequently to a greater distance before it has so far dispersed as to be no longer capable of producing an effect upon the receiving instrument, and moreover, that the positive and negative impulses are equal in amount.

The success of a long submarine line of electric telegraph depends also in a great measure upon the particular construction of both the communicating and receiving instruments. On this point I am in a position to speak from extensive experience, being connected with an establishment which had to contend at an early period with the difficulties experienced upon long underground lines, which has since carried out extensive systems of telegraphs in Russia and other countries, and has furnished the instruments of most of the continental lines, including those in Turkey, India, and Australia. In addition to this there is the experience of the Black Sea and the Mediterranean lines, which are the longest submarine lines hitherto constructed, with the instrumentation of which I was charged by Messrs. Newall and Co., the successful contractors of those undertakings.

Morse's recording instrument combines, as stated before, many practical advantages which recommend it for universal adoption for all mercantile lines, among which advantages is the facility it offers of forwarding messages at intermediate stations without the intervention of a clerk, in putting on a fresh battery, a system first introduced by Siemens and Halske, and perfected by Steinheil, by which it is made possible to speak directly between London and the remote parts of Russia.

The real telegraphic receiving instrument is the relay, which has for its duty to establish and break the local circuit of the recording instrument.

An important point in the construction of a delicate relay was the suppression of the armature of the electro-magnet employed (patented by Werner Siemens in 1851), by allowing one of the two upright bars of soft iron composing the horse-shoe electro-magnet to vibrate upon delicate points, and producing rotary motion by the attraction between approximated horizontal arms extending from the same. The application of magneto-electric currents necessitated a corresponding change in this relay; for, however sensitive it might be made, it was necessary that the effect of the line-wire current should be continued till the recording instrument has had time to make a dot or line upon the paper, and the magneto-electric current, being nearly instantaneous, is unsuited for that purpose. This difficulty has been removed by the introduction of permanent magnets, which continue the effect produced by the instantaneous action of the line-wire current, until the opposite effect is produced by the succeeding negative current. The vibrating tongue of the instrument (Figs. 2 and 3), is for this purpose balanced midway between the similar poles of a comparatively powerful permanent magnet, being equally attracted by both, but remaining in the proximity of either of them, into the attractive sphere of which it happens to be brought by the instantaneous action of the line-wire current, changing for an instant of time the name of one of the contending poles. A relay on this principle was first exhibited at the Great Exhibition of 1851 by Siemens and Halske.

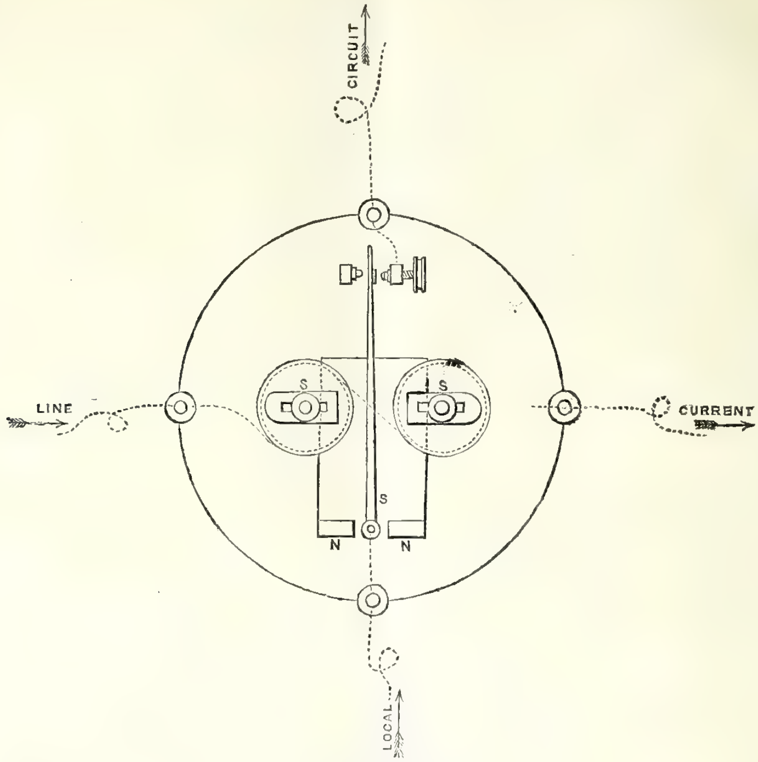
The relative dimensions of the inductive coils, and of the coils in the relay, (depending upon the length and other conditions of the cable itself), are points which require very careful attention. The common practical rule, that the resistance of the coils must be increased with the increased length of conductor, is here entirely at fault, for the electric wave, when once formed, is no longer under the influence of its source, but may be compared to the dying wave of the ocean running up a shallow beach, which would have no power to force its way through a long and narrow tube, but is yet capable of delivering a large quantity of water into an open duct. For an analogous reason the coils of the relay must be composed of comparatively short and thick wire. The same rule applies to the inductive coils, which must be composed of thick wire in order to produce a quantitative wave. The Cagliari, Malta, and Corfu line is worked by instruments upon this principle, and the results obtained are very satisfactory—the messages being worked through the entire distance of 700 nautical miles (without making Malta a relay station) with ease, and at a sufficient rate.

This result proves that telegraphic cables not exceeding a thousand miles in length may be worked satisfactorily, and that, consequently, all reasonable doubts about the successful operation of a line from London to Calcutta may be considered as being removed, a result which I sincerely hope to see soon established in fact.

For distances exceeding a thousand miles, the difficulty of sending messages at an efficient rate for commercial purposes remains yet to be solved, for theory and experience combine to prove that the highest rate likely to be attained in working through a distance equal to the intended Atlantic cable, in taking full advantage of the power of waves, will not exceed three, or it may be four, words per minute, unless indeed some new principle of working is yet discovered, whereby a greater result is realised.

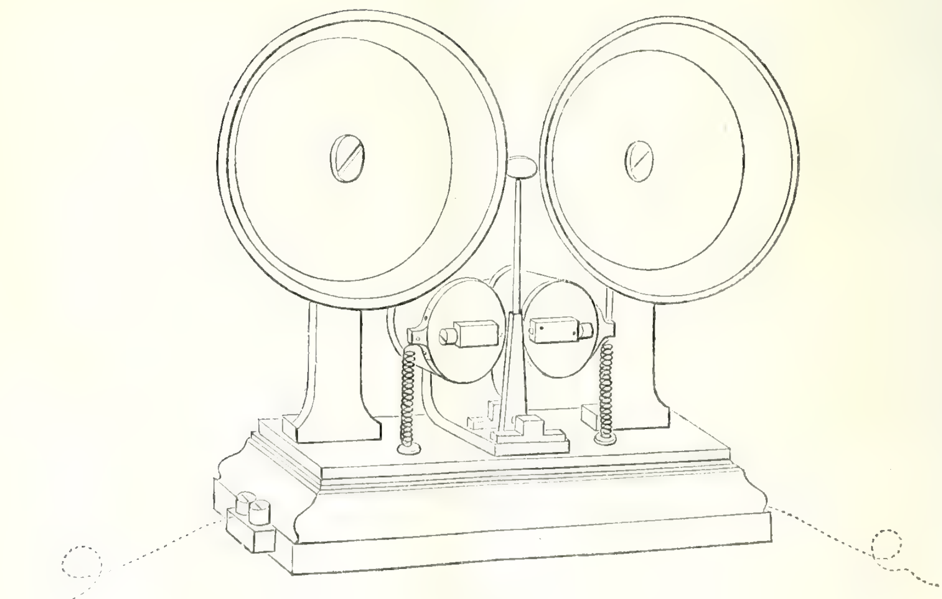
There would be one way, indeed, in which the capabilities, not only of long submarine cables, but of electric telegraphs generally, might be greatly increased,

Fig. 2.



INDUCTIVE RELAY.

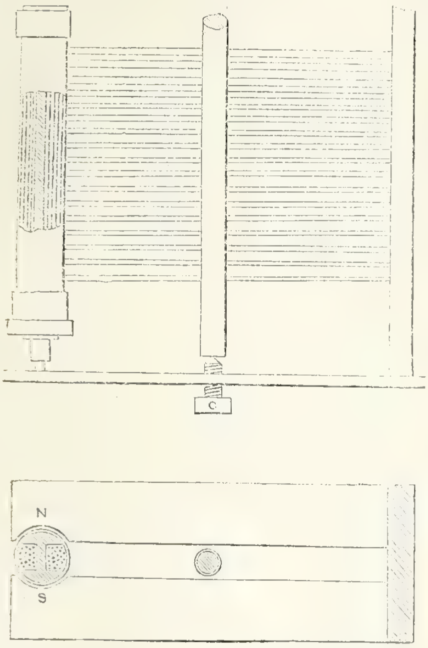
Fig. 3.



INDUCTIVE ALARUM.

which consists in combining a number of insulated line-wires into one cable, and working them in metallic couples. This, indeed, is giving up the earth circuit, but, in its stead, we gain the power of working several sets of instruments without disturbing interference between the wires by Voltaic induction. Instead of using one of the wires (say the central wire) for the common return circuit, the metallic pairs might be selected by the rule of permutations, which, if carried out, would enable us to connect 6 pairs of instruments by means of 4 wires, 10 pairs by means of 5 wires, and so on. If a cable of 10 wires was laid between two great commercial centres, say between London and Liverpool, as many as 42 pairs of instruments might be used, which might be placed in the counting houses of great merchants and of their respective agents for their private correspondence, and this step would probably give rise to the more general application of the electric telegraph for private and domestic communication. The instrument that appears to be best suited for such purposes (including railway and town services) is a magneto-electric step by step or dial instrument (Fig. 4), a specimen of which I have placed

Fig. 4.



COMMUNICATOR OF DIAL INSTRUMENT.

before the meeting. This instrument combines the advantages of requiring no battery, with great facility of working, and it contains some novel arrangements, whereby its action is rendered powerful and certain, and which will be best understood from the drawing.

Of these instruments, 180 were adopted last year by the Bavarian Government, in lieu of instruments of a similar class that had been used there previously, and it appears, from an official document, that they give great satisfaction. A pair of them is also in use at the War-office and the Horse Guards; and another pair was taken out by Messrs. Newall and Co., to keep up telegraphic communication between the tender and tug employed in laying the last Mediterranean cables.

My summary of telegraphic novelties would not be complete without a notice of a method of sending messages simultaneously in both directions through one and the same line-wire, the joint invention of the Hanoverian telegraph engineer Frischen and my brother. It consists in splitting the current of the battery into two equal parts, of which the one proceeds through the line and the other through an adjustable resistance coil by a short circuit to the earth. Both currents pass in opposite directions round the relay magnet of the communicating station, and neutralise each other in effect, but the portion of current passing along the line-wire, produces an effect upon the relay at the receiving station, and *vice versa*, but if both stations include their batteries at the same time, the current of the line-wire will be doubled, and in exercising a preponderating effect upon both relay magnets, will cause both to attract their respective armatures, and establish the printing circuits. By this means, the transmitting power of a single line-wire is doubled. This system works satisfactorily between Amsterdam and Rotterdam, and some other places where there is not much interference by intermediate service, but it is, I consider, as yet too refined for general application. The same objection applies to a system of accelerating the speed of transmission of messages by preparing strips of perforated paper which, in passing between a metallic roller and contact finger, break and restore the metallic current with unlimited rapidity; a system first introduced by Bain, years ago. These plans will very probably be of great practical utility eventually, when the use of the electric telegraph is more extended.

In conclusion, I have to thank the meeting for their patience in listening to this paper, which far exceeds the limits I had assigned to it. I have to express my special thanks to Professor Wheatstone, Mr. Latimer Clark, Dr. Green, Mr. Edward Bright, and Messrs. Newall and Co., for their liberal aid, in furnishing me with models to illustrate the subject.

I wish to draw particular attention to the key and relay arrangements of Mr. C. Varley, which are used upon the Dutch cable, and the acoustic telegraph, worked by secondary circuit, which is used by the British Magnetic Telegraph Company, and which lack of space has prevented me from describing in the paper. The paper is, I am aware, deficient in many respects; but I shall be satisfied if I have succeeded in showing, by what has been done, what greater results may yet with certainty be accomplished, and if, by inviting discussion, I have contributed to hasten the period when the electric telegraph will no longer be the wonder of the age, but will become the simple and ever-ready agent to extend the range of human intelligence and power upon the earth, fettered no longer by the limits imposed by distance.

In conclusion, Mr. Siemens explained the numerous instruments and diagrams before the meeting, amongst which were the early needle telegraphs, by Cooke and Wheatstone; Professor Wheatstone's dial instrument and early magneto-electric arrangements; Bain's chemical telegraph, and Henley's double needle telegraph; the instruments in actual use by the Electric and British Telegraph Companies; the arrangement of instruments used in working the Dutch cables, consisting, on the English side, of Mr. Varley's arrangements, and on the Dutch side of Siemens and Halske's recording instruments; the recording instruments worked by induced currents (produced by a Rohmkorff coil) used on the Mediterranean cables; Siemens and Halske's new step by step or dial instruments, and the recording instruments by the same firm, which were used upon the East Indian lines and elsewhere; besides a variety of rotary apparatus, alarums, &c.

DISCUSSION.

The Chairman, in inviting discussion, said that perhaps it would be as well that speakers should apply themselves more to general topics, than to the mechanical details of the instruments before them. In looking at the array of apparatus on the table, it was wonderful to think that the whole of these inventions had resulted from the scientific researches of the last half century, which showed how rapid had been the pro-

gress of electric science. He thought that important points for discussion were, the best means of insulation and the best form of battery power. It would be interesting to hear observations upon these two subjects. At present it did not appear that for long lines of telegraphic communication a better insulator than gutta percha could be found, which combined a great degree of insulation with plasticity, toughness, and strength to resist the ordinary accidents to which telegraphs were subjected. It had been remarked by Prof. Faraday that various specimens of gutta percha differed in conducting power, as also in durability. Doubtless very considerable steps in the improvement of the electric telegraph would be effected if they could with certainty produce gutta percha of a quality giving it a greater power of insulation. Another important point was—what was the best form of power to be used for the transmission of the electric current. That must necessarily differ according to the uses to which the instruments were put. A different power was required for short distances to that which would be suitable for long distances, such as the Atlantic telegraph. One advantage of magneto-electric power, as opposed to that of the battery, was that the apparatus was always ready, and only required small mechanical power to work it. It had been found to answer well for short distances, and, with regard to its applicability to long lines, no doubt some opinions would be given that evening. There had of late been many improvements in the means of inducing electricity of high power; for instance, the Rhumkorff coil, by means of which a great increase in the power of the current had been produced; and thus immense intensity was obtained with a comparatively small battery. It was stated that in order to obtain sufficient intensity to work a length of telegraph such as the Atlantic cable, they would require 500 Daniell's cells, whilst with the Rhumkorff coil it was probable they would be able to obtain sufficient intensity with a much smaller number. Another important point was the occasional rupture of the copper wire in submarine cables. It was argued that by having the outer iron sheathing of a twisted or spiral form, whilst the wires of the inner core were straight, there was a greater power of stretching in the outer than in the inner wires, and he did not know how far the breakages that had taken place were due to that circumstance. He thought, however, it was very desirable to have the whole cable so constructed, that the stretching of the wires, if any, should be uniform, and that one part of the cable should not stretch in a greater degree than the other.

Mr. W. Smith thought Mr. Siemens was slightly in error upon one or two of the facts he had brought forward. He had stated that the first attempt to establish a subaqueous conductor across the open sea, was made by Wollastone (from Dover to Calais), in 1850; and that in the following year Crampton laid a cable between the same places successfully. This cable, it was added, was sheathed with iron wire, according to Messrs. Newall and Co's patent process. He (Mr. Smith) thought there was some mistake here, inasmuch as he was not aware that Messrs. Newall and Co. had any patent for that form of cable. The fact was that in 1847 the first specimens of that form of cable were made for Mr. Brett, who, he believed, patented a system of interoceanic telegraph in the year 1845. Mr. Brett's plan was to coat copper-wire with india-rubber—the best insulator then known—and to enclose the wires in a series of iron tubes, united by ball-and-socket joints. He (Mr. Smith) had no wish to advance any claim to invention in connection with submarine telegraph cables, but he would state that he believed he was the first to communicate to Mr. Brett, in 1847, the idea of protecting the insulated copper-wires forming the core, by a sheathing of iron-wire. Mr. Brett adopted the idea, and in the same year some specimens of that form of cable were made for him. That was long prior to the construction of the Dover and Calais cable. The cable to which Mr. Siemens alluded, was manufactured at Wapping, and was only completed, but not commenced, by Messrs. Newall and Co. It was in consequence of some little difference with the contractor, that Messrs. Newall and Co. undertook to complete the cable, which was done with the very machinery which was originally designed for the manufacture of that form of cable.

Mr. Latimer Clark, in reference to the acknowledgment of the labours of Oersted and Ampère in the advancement of electrical science, had been lately struck by a passage in a French work on electricity, published in 1805,* from which it almost appeared that the influence of an electric current on a magnetic needle, and its effect in magnetising an iron bar, had been noticed and published long prior to the date of Oersted's discovery. Mr. Siemens had erroneously attributed to Professor Faraday the discovery of the possibility of the co-existence of several waves of electricity in one submerged wire. The phenomenon of the slow transmission of currents through submerged wires, was first noticed by him (Mr. Clark), in April, 1852, in the course of a series of experiments undertaken at the works of the Gutta Percha Company, to ascertain how far it would be practicable to work through gutta percha wires laid underground between London and Liverpool; and, in 1853, a patent was taken out to obviate the effect by surrounding the gutta percha wire with a coating of asphalt, or some cheap dielectric substance. The Electric Telegraph Company having completed eight underground wires from London to Liverpool, and meeting with much annoyance from the induction, Professor Faraday and Professor Airy were requested to attend at Lothbury, and, early in 1854, he (Mr. Clark) exhibited the phenomena of induction, and produced diagrams with three needles on chemically prepared paper, showing, in a very perfect manner, the passage and retardation of the current. These diagrams were afterwards exhibited by Professor Faraday at the Royal Institution, and formed the subject of a lecture there. He (Mr. Clark) had not met with much practical inconvenience from the breakage of the internal copper wire in submerged wires and single submarine cables, and cases of fracture were very unfrequent. In deep submarine cables, where every precaution was requisite, the difficulty had been successfully surmounted by the use of the twisted strand of wires, but as this necessarily occasioned some additional resistance, he did not consider its universal adoption desirable. With reference to the general use of the double-needle instrument in England, he thought this was not the result of any prejudice, but a consequence of the intrinsic merits of the instrument itself, which were such, that when persons had once become familiar with its use, nothing but compulsion would induce them to resort to any other. The Electric Telegraph Company were fully alive to the advantages of the Morse instrument, and had employed it extensively on all their principal commercial circuits for many years, and it was in daily operation on thousands of miles of telegraph in

* *Manuel du Galvanisme*, par Joseph Izarn, Paris, 1805. The passage is as follows, p. 120:—"Appareil pour reconnaître l'action du Galvanisme sur la polarité d'une aiguille aimantée."

"*Preparation.* Disposez les tiges horizontales, *a*, *b*, *d*, de l'appareil, Fig. 53, (a common universal discharger), de manière que les deux boutons se trouvent à une distance un peu moindre que la longueur des aiguilles que vous voudrez soumettre à l'expérience; et, à la place des boutons *b*, *b*, qui sont vissés sur leur tige respective, adaptez aux tiges, ou une petite pince, ou bien un petit ajutage applati. *Usage.* Après avoir placé l'aiguille, de manière que ses deux extrémités soient prises dans les deux petites pinces, établissez une communication de *d*, avec une des extrémités d'un Electromoteur, et de *a*, avec l' extrémité opposée. *Effets.* D'après les observations de Romagnesi, physicien de Trente, l'aiguille déjà aimantée, et que l'on soumet ainsi au courant galvanique, éprouve une déclinaison; et, d' après celles de J. Mojon, savant chimiste de Gènes, les aiguilles non aimantées acquièrent, par ce moyen, une sorte de polarité magnétique."

this country. The needle instrument had, however, such advantages over the Morse in simplicity, in rapidity of transmission, and in facility of use, that they had in vain endeavoured to bring the Morse instrument into extensive use on railways. Nothing but the constant use of the two instruments side by side could enable a person to form a correct estimate of their relative value; and he could assure those who were in the habit of condemning the double-needle instrument on purely theoretical considerations, that they were, from imperfect information, falling into a very great error.

Mr. E. Highton said he objected to the statement in the paper—that the change from magneto-electricity to electricity developed directly by a voltaic battery, was a step in a retrograde direction. Every form of magneto-electric machines hitherto used in Great Britain and Ireland had failed; he instanced the instruments of Professor Wheatstone and Mr. Henley — instruments which, he believed, showed inventive talent of the highest order, but they were not commercially comparable with other plans when voltaic-electricity was employed. The first system of underground wires, as recommended by Mr. Werner Siemens, in Prussia, had proved a total failure, and nearly the whole of the capital invested therein by the Government had been lost.—He preferred the use of electricity produced by a battery and an electro-magnet, to that produced by a permanent magnet, inasmuch as the one could be increased to any extent, according to the weather, while the other could not. He objected to the statement in Mr. Siemen's paper as to Messrs. Newall and Co. being the patentees of the submarine telegraph as now used. The fact was, there was no practical method of making submarine cables published, prior to his own patent of September 21, 1850. He corroborated the statement of the author as to the immense risks that must be incurred in laying submarine cables in great depths of the ocean. He thought that the attention of those connected with the working long lengths of telegraphs should now be directed to a system of codes. He instanced one of his own which contained 800,000,000 times 2,000,000 pre-concerted messages, all of which did not occupy one side of half a sheet of foolscap, and each would not occupy more than twelve seconds in transmission. Although Mr. Siemens had stated that by his instrument he could communicate between London and Odessa, there was no proof that this had been done. With respect to insulation, Mr. Highton remarked that this depended very much on the climate of the country to be passed through. He considered that for England and the west of Ireland, a different kind of insulation was required from that suitable to Italy or India, and such like countries. The telegraphic instruments, batteries, and other apparatus to be employed, ought to be suited to the work to be done, and he believed there was no one telegraphic instrument suitable to all cases throughout the world, but that each particular case required its own special apparatus. With regard to the purification of gutta percha, which had been alluded to by the chairman, he was happy to say that the Society had appointed a committee to investigate the whole subject, and he hoped that great results would accrue from their investigations. With regard to the breaking of the internal copper wire in submarine cables, he remarked that in the specification which he made for the British Telegraph Company's cable between Scotland and Ireland, he put in a clause which compelled the contractor for the making of the cable to give double the lay or twist in the copper wires to that of the outside iron wires, and thus prevent all strain from coming upon the copper wires until the iron wires had broken. The submarine cable of the British Telegraph Company had been most successful. Although weighing 180 tons, and containing six wires, of 25 miles in length, it had now been at work for nearly four years, and every wire up to the present moment was perfect, and since its submergence it had not cost the company anything for repairs. With regard to the double-needle system of the original Electric Telegraph Company, he stated his belief that, sooner or later, if they were to compete with their rivals, they must use a one-wire system. Mr. Highton then read an extract from a work published by Mr. Ronalds, in 1823, which showed that the first telegraphic messsage ever transmitted in Europe was transmitted by an Englishman, in the year 1816. and that Mr. Ronalds then recommended the use of underground wires. Mr. Highton then exhibited and explained the instruments invented by himself, and used by the company with which he was connected, and which, through one wire, transmitted the last parliamentary speech of the Queen from London to Liverpool at the rate of 32 words a minute; and, through the same kind of instrument, with three wires, the speech of the American president, containing upwards of 16,000 words, was telegraphed from Liverpool to London at the rate of upwards of 3,500 words an hour, without a single mistake. He was sure that every one present would join in a vote of thanks to Mr. Siemens for his interesting paper.

Mr. Pearsall regarded the historical record of the electric telegraph, presented to them that evening, as of great value, especially that portion which referred to the experiments of Steinheil. Some years ago, in passing through Bavaria, he (Mr. Pearsall) was charged to ascertain the practical results of Professor Steinheil's researches and experiments, when the Professor stated that he had carried on electro-telegraphic communication without any wire at all, by which he now understood him to mean that he had made use of the rails of the railroad for the line wire, using the earth for the return circuit. With reference to the use of wire rope, he recollected that when the plan of metallic shutters to shop fronts was first introduced, it was found that great wear and tear was experienced in the friction of the chain by which the shutters were raised and lowered; this had been obviated by the introduction of a rope of twisted wire, sufficiently flexible for the purpose. In the course of the experiments for ascertaining what was a proper material for the purpose, attention was drawn to the means by which the extraordinary flights of ballet aerials on the Italian stage were effected, which was found to be by means of twisted wire rope, and the idea was at once adopted. The machinery then used for the manufacture of wire rope was the same in almost all its details as was now employed in the manufacture of the outer sheathing of submarine telegraphic cables.

Mr. Varley mentioned that his attention had been accidentally directed to the possibility of constructing a telegraph, the signals of which would be communicated by the sense of touch. He had himself been able, by touching the wire whilst an instrument was at work, to interpret the signals by feeling; and he thought possibly this idea might ultimately be practically worked out. Mr. Varley also gave a description of an instrument exhibited by him, termed the acoustic telegraph. He begged to ask Mr. Siemens at what rate the Malta cable was worked?

Mr. Siemens replied he believed at the rate of about 12 words per minute, though that very much depended on the skill of the operator.

Mr. Varley added that the experiments with the Atlantic cable had led certain electricians to the conclusion that a small wire conducted more rapidly than a large wire, a conclusion with which he (Mr. Varley) did not agree. If it should be established that the larger wire was the best conductor, he did not apprehend that the expense of a submarine cable would be materially increased by its adoption. The cost of the present Atlantic cable was about £100 per mile, of which sum £60 was due to the outer iron sheathing, and £40 to the copper wire and gutta percha covering, and of this he thought the gutta percha cost the larger portion.

Mr. Siemens said, in reply to Mr. Smith, that whatever his or Mr. Brett's merits might be in having first suggested the long spiral iron sheathing of electric cables, there could be no doubt about the fact, as stated in his

(Mr. Siemens') paper, that it was actually constructed according to the process patented by Messrs. Newall and Co., for twisting wire ropes. He felt surprised at Mr. Latimer Clark's assertion, that Oersted, Schweigger and Ampère were not the originators of the science of electromagnetism. The electric charge in underground linewire was first observed by his brother, Werner Siemens, and fully described in a memoir, presented to the French Academy in 1849, whereas underground linewire had not been introduced into this country till 1854. He was glad Mr. Clark acknowledged the superiority of the recording over the needle instrument, but did not feel surprised at his defending the latter, very much on the principle upon which one would defend an absent and dying friend. Mr. Highton had also defended the needle instrument, on account of its comparative simplicity and speed. There might be some degree of force in that argument in regard to this country, where the lines were comparatively short, but a needle telegraph was certainly inadmissible for long and international lines of communication. The defects of the needle telegraph system in this country were, however, sufficiently manifest from the distortions of names and figures which occurred in almost every message received. Mr. Siemens could not admit Mr. Highton's argument against the application of magneto-electric and induced currents. Their failure in all the early attempts had been admitted in the paper, and might be very clearly traced to the short duration of the induced current, which rendered it unfit to exercise any sustained or visible mechanical effect upon the receiving instrument; but he mentioned that, in the construction of the instruments he had placed before the meeting, a new and most important feature had been introduced, that of sustaining the effect produced by an instantaneous current, by means of permanent magnets, the instantaneous line-wire current being only required to disturb for an instant of time the equilibrium between two equal and contending poles. Instruments constructed upon this principle required no adjustment according to the distance and other circumstances, which was another very important point, and there was hardly any limit to be assigned, to which the delicacy of the instrument might not be carried. The chief advantage of induced currents for submarine lines, consisted, however, in their perfect equality.—Respecting the new dial instrument, he wished to draw the attention of the meeting to the means adopted to obtain quantitative induced currents by the application of a series of permanent magnets acting in close proximity upon a long rotating keeper, of the section of the letter H, into the recesses of which the induced wire was coiled, by which arrangement a powerful alarum might even be sounded at a distance of 500 miles, to which distance these instruments worked with absolute certainty. The dead-beat ratchet-motion was also of peculiar construction, which rendered the slip of a tooth impossible even at the highest velocity at which the handle of the instrument could be worked. The mode of receiving messages by touch, which had been mentioned by Mr. Varley, was not new, the same plan having been proposed by Vorsselmann de Heer (see Pogg. Ann., vol. 46, page 513), in 1839. The most suitable diameter of the conductor, in submarine cables, under given circumstances, might be ascertained, without much difficulty, from the simple formulæ which he had given, and which he had hoped would have formed a principal point in the discussion.

The Chairman said it was now his pleasing duty to call upon the meeting to join him in a cordial vote of thanks to Mr. Siemens for his very elaborate and valuable paper. He had almost hoped to have heard the battle of magneto-electric and battery power fought over again, as he saw advocates of both systems present. Professor Wheatstone was avowedly in favour of the magneto-electric power, and there had been of late many important improvements in that direction. They had heard that evening one extraordinary communication from Mr. Latimer Clark, which came with great surprise upon all who were acquainted with the normal history of electricity. This statement was, that Oersted was not the first discoverer of electro-magnetism. If a priority of discovery were established on behalf of any other person, it would come with great surprise upon those who had been accustomed to associate that discovery with the name of Oersted since the year 1821. The only scintilla of any prior claim to the discovery was that which was vaguely put forward by Ritter, a man who was no doubt very much underrated in his day. The Chairman concluded by proposing a vote of thanks for the paper which had been read.

A vote of thanks was then passed to Mr. Siemens.

The Secretary announced that on Wednesday evening next, the 28th inst., a Paper by Mr. J. Arthur Phillips, "On the Progress and Present State of British Mining," would be read.

ARE MECHANICS' INSTITUTES A FAILURE OR A SUCCESS?

The following letter, addressed to the editor of the *Times*, has appeared in the *Leeds Mercury*.

Sir,—I am sure you would not willingly discourage efforts made by the people themselves for their own intellectual and social improvement; yet I fear your remarks, on the 6th instant, relative to Mechanics' Institutions will have that tendency. Will you allow one who has seen a good deal of these Institutions, from their origin in England to the present time, to lay before you and your readers facts and considerations which prove that these popular associations have done much good, and may be expected to do much more.

In order to judge correctly of the success already realised, or likely to be realised by Mechanics' Institutions, we must consider the objects for which they were established. Those objects were, to promote the intellectual and moral improvement of young men of the industrial classes, to counteract the temptation to sensual indulgences by which they are beset, to supplement an imperfect education, and to introduce to the study of science or art those whose talents or avocations especially led them to such pursuits. They were not intended to be universities, or colleges of science, or academies of art, to give a high and perfect training, such as would make professors, artists, engineers, &c. This was in the nature of things impossible, seeing that their members consisted of young persons engaged during the day in industrial pursuits, and having only their evenings to spare for study, with scanty means for the purchase of books and materials. The ambition of founders of Mechanics' Institutions was extensive rather than lofty: it was to imbue a whole population with intellectual tastes, not to turn out a few accomplished scholars and *savans:* it was to circulate books through the homes of the humbler classes—not to train authors: it was to assist self-education—not to set up and carry on the complete machinery of education.

Have Mechanics' Institutions, then, in any considerable degree succeeded in attaining these objects? I cannot answer in a very confident or exulting strain, because I know many instances in which they have not effected all that was hoped from them, and some in which for the time they appear to have quite failed. But is there any kind of institution, social or political, governmental or popular, which we can pronounce to be absolutely successful, and especially to have attained all its objects within a single age? Can we assign either perfection or complete success to any of the grand agencies which are carrying on our civilisation—to the pulpit, to the press,

to the university, to the school, to our free political in- institutions, to parliament itself, to our charities, to our savings banks, to our provident societies, to our administration of justice, to our prison discipline, to our philosophical societies, our academies of art, or our schools of design? In all these things success is partial, and often delayed—perhaps the failures more numerous than the successes; and not unfrequently it is by failure that we learn how to succeed. Our duty is to persevere, to profit by experience, and, if we do not realise all the social improvements we desire, still to press on with a hopeful though modest courage. On the whole, amidst all our failures, society is advancing in knowledge, virtue, and religion—and it is advancing by means of instrumentalities, every one of which we feel to be imperfect.

You have been disheartened by the debts, the mistakes, and the declining numbers of the London Mechanics' Institution. I fear that not a few other instances might be found of similar want of success. But such failures may arise from special circumstances, not from any fault in the principles of the institution. Permit me to mention a few facts, which may revive your hopes concerning this important class of popular associations.

The first Mechanics' Institution formed in England was established in the year 1823. When the census was taken in 1851, returns were received from *one thousand and fifty-seven* Institutions, by far the greater number of which belonged to this class. Dr. Hudson, whose "History of Adult Education" was published in the same year, had obtained independent returns of these Institutions; and he gives a list of 622 Institutions in England and Wales, containing an aggregate of 103,522 members, and with libraries containing 697,355 volumes. We may be certain that neither Dr. Hudson's returns, nor even those of the census, were complete. In the county of York alone, and connected with the "Yorkshire Union of Mechanics' Institutes," we have more than 130 Institutions, containing together 21,000 members, with libraries containing 110,000 volumes, and 300,000 issues of books yearly. At these Institutions, many of which are in villages, an aggregate of 800 lectures were delivered last year. They receive 850 periodicals and 720 newspapers in their reading rooms; the number of pupils in the evening classes is about 6,500; the aggregate yearly income of the Institutions exceeds £11,000. But there are numerous Institutions in this county not connected with our "Union," yet formed on somewhat similar principles.

From these facts may we not take encouragement? Many, like myself, remember the time when neither in our villages nor even in our large towns (with very few exceptions) any of these Institutions existed. At that time, the means of literary and scientific information were extremely few. When Mechanics' Institutions were originated by the practical genius of Dr. Birkbeck, and recommended by the powerful pen of Henry Brougham, they were hailed with delight by the friends of education and improvement, as meeting one of the most crying wants of the age. They consisted of three main features—1st, a library; 2nd, lectures; and 3rd, evening classes. Each of these features is admirably calculated to meet the intellectual wants of the industrious classes. Look, for example, at the library. A working man would perhaps not spend more than ten shillings a year in buying books, and for this sum he might obtain three or four volumes; but suppose 200 working men were to subscribe ten shillings a year each towards a library, they would raise £100, with which they may purchase six or eight hundred volumes, every one of which would be accessible to all the subscribers. But if they choose to lay out only one-half or one-quarter of their money on books, they may still form a good library, and add to it a reading room, occasional lectures, and evening classes. From the lectures they may obtain intellectual stimulus and gratification; and in the evening classes—by far the most valuable department of an Institution—the young may acquire solid and systematic knowledge, together with the habit of steady application, which will be invaluable to them in the pursuits of life.

I hope this very simple explanation may be pardoned, for the sake of the practical importance of the subject. Whether we look at the positive or negative effects of Mechanics' Institutions, they are of great social value—negatively, by saving multitudes of our youth from intemperance and vice; and positively, by training them up to be valuable members of society. I know numbers who have risen from the forms of the evening classes to the position of employers and teachers—some to great prosperity and eminence as manufacturers, engineers, professional men, lecturers, and authors.

May I not, then, regard it as proved that Mechanics' Institutions have to a great extent succeeded? But admitting that the success has not been equal to the wishes of their friends, I would point out that they are almost in their infancy, and that they are receiving, and may still hope to receive improvement. The object of our Unions of Mechanics' Institutes is to ascertain and establish the best modes of management, to communicate to each other the results of experience, to encourage, to stimulate, to help, and to form new Institutions. Some of the Unions employ lecturers, exchange written lectures and papers, lend apparatus, establish itinerant village libraries, collect statistics, form catalogues of books, and provide model rules for the management of Institutions.

One of the most recent and valuable improvements consists in the establishment of a system of examinations for the students of Mechanics' Institutions, and the awarding of certificates or prizes to candidates who acquit themselves well. The Society of Arts in London, which itself forms the centre of a great Union of Institutes, organised a plan for this purpose, which has undergone some changes, but which seems likely to lead to very beneficial results. It is designed to stimulate the teachers and students in the evening classes. Last year there was an examination at Huddersfield, chiefly for the Institutions of Yorkshire, when the following number of candidates presented themselves in the subjects specified, namely, 33 in arithmetic, 18 in mensuration, 12 in trigonometry, 5 in conic sections, 3 in natural astronomy, 7 in statics and dynamics, 6 in practical mechanics, 4 in hydrostatics and pneumatics, 3 in electricity, 4 in heat, 7 in chemistry, 1 in physiology, 1 in political and social economy, 17 in English history, 15 in geography, 9 in English literature, 7 in Roman history and Latin, 17 in French, 8 in German, and a considerable number in drawing. This list indicates that a large range of subjects is taught in some of these Institutions, and the reports of the Examiners expressed satisfaction with the attainments of the students.

I may add that these voluntary associations produce two incidental advantages of the utmost value to our social condition. First, they bring into friendly cooperation men of the different ranks of society, of all religious denominations and all political parties, thus binding together the high and the low in bonds of mutual sympathy and regard, and abating the prejudices which too often embitter party and sect. And, secondly, they call forth the self-relying energy of the people, their public spirit and benevolence, in sustaining organisations for their own and each other's intellectual and social improvement. In most other countries of Europe, the people look to their Governments for these things, where any such Institutions exist at all. In England it is our pride to do them for ourselves, as becomes a free people; and the efforts thus put forth cultivate the virtues of the people, and develop more fully the noble spirit of independence which is the only safeguard of liberty. It is in their

voluntary character that the life and power of these Institutions consists. If they should ever accept pecuniary help from the Government, they will put themselves into bondage, as well as into the ruts of routine, which will make their future improvement hopeless. I trust the real friends of popular advancement will never allow themselves to be seduced into so fatal an error.

Mechanics' Institutions have succeeded to the full extent that they could have been expected, if not to the extent we had wished. They are susceptible of continual improvement, and of adaptation to the tastes of the people and the changing circumstances of the times. When well managed, they flourish. When ill managed, they fail, as it is desirable they should, and ere long better Institutions rise in their place. On the whole they are doing immense good, and they deserve to be cherished as one of the best features of the age.—I am, Sir,

Your most obedient servant,

EDWARD BAINES,
President of the Yorkshire Union of Mechanics' Institutes.

Leeds, April 17, 1858.

PLATINUM OF BORNEO.

Communicated by Professor S. Bleekrode, Royal Academy of Delft.

Several authors on the statistics of metal mention Borneo as a source of the valuable metal Platinum, so much required in the chemical and industrial arts. There are some who calculate that Borneo can produce from 250 to 400 kilograms yearly. It is surprising, but not the less true, that up to the present time the collection of platinum there has been almost neglected.

In 1831, the resident of Banjarmassin, Mr. Hartman, found the platinum scales in the gold sands, and Dr. L. Horner has confirmed it for all the gold sands that are worked in the valleys of the Ratoes mountains of the Laset district. The observations of this much-lamented naturalist soon found their way into the European journals, having been communicated by Leopold von Bach to Humboldt, who called it "Eine bis jetzt wenig bekannte Erscheinung" (Central Asien, 1843 p. 365).

Dr. Horner estimated the amount of platinum in the gold sands of Borneo as one of platinum to ten of gold, and in this proportion he calculated the eventual produce of that island at 300 kilograms (six cwt. per year), and this could possibly be augmented.

The existence of platinum was afterwards confirmed by other naturalists of the Dutch government. Dr. S. Muller, who visited the southern district of Borneo, has given a description of the diamond mines of Martapoera; after the separation of the diamonds by washing the sands, there remain gold and platinum scales; the gold is carefully collected, but the platinum is rejected as valueless, under the name of *mas kodokh* (gold for the frogs), because neither the Chinese nor the natives know how to work it.

Dr. Schwaner, who travelled through the district of the river Barito and the South-Eastern country, during 1843-47, has given an accurate description of the geological position of the three very valuable minerals, diamonds, gold and platinum, as they are associated together in the diluvium of that island. It appears that the same kind of diluvial *débris* from the rocks of the mountains and hilly districts is found, but the relative proportions of the three valuable minerals in it are very different. Where the diamonds are numerous, gold and platinum are scarce, and, on the contrary, where the grains of the noble metals are abundant, the diamond is rarely found. Gold and platinum are also dispersed over a larger area than the diamonds. The diluvial deposits lie superficially in the higher districts of the rivers and their mountain tributaries; in the lower country the diluvium is covered by the more recent alluvial deposits of the marshy grounds near the coast. The diluvium consists of conglomerates and rock fragments of diorite, syenite, gabbro, quartz in different colours, but the milky quartz is more general; the minutest parts are quartz sand and magnetic iron-sand. The thickness of the diluvial stratum varies between a few feet and as many fathoms. The depth below the surface is likewise very variable and irregular. The subsoil is a kind of loam, the thickness of which is not yet ascertained.

It is very remarkable, that in some districts the platinum ore contains grains of *cinnabar*, especially at Playhary. We have stated above that the proportion between gold and platinum is as 10 : 1; but this relationm is very variable, because at Katapan it is 5 : 1, at Soengi-Matjan 20 : 1.

Last year I received a sample of the Borneo platinum ore, which is now beginning to attract the attention of our commercial society. The results of my analysis are as follows:—

Platinum Ore of Banjarmassin.

Separated by solution in hydrochloric acid.	Iron-oxide and iron	1·13
	Copper	0·50
Osmium		1·15
Gold		3·97
Platinum		70·21
Iridium		6·13
Palladium		1·44
Rhodium		0.50
Iron		5·80
Copper		0·34
Insoluble in aqua regia: Osmiridium and minerals		8·83

The osmium was separated by distillation as described by Berzelius. The analysis was executed, following the method of Berzelius and Claus (*Beiträge zur Chemie du Platin metalle*, 1854). The method of Claus is highly commendable for the ease with which the separation of the platinum from the iron, copper, and gold, is effected.

By the magnet no particles could be separated from the ore. It is probable that this had been done before it was forwarded to Europe. It is interesting here to reremark on the magnetic properties of platinum. Berzelius was the first who discovered that there existed a magnetic platinum ore and a non-magnetic ore, notwithstanding that the latter contains nearly the same amount of iron combined as the magnetic-ore. His analysis of the platinum ore of Nischnei-Tagilsk, separated into the magnetic and the non-magnetic parts, is generally known, so that it is not necessary to repeat it here. The platinum ore of the Ural, of Pinto in South America, contains likewise a combination or alloy of platinum and iron. The platinum ore, as it is commonly called, is a mixture of different alloys, with iron, copper, and the other platinoid metals. The natural combinations of platinum and iron remind us of the original discovery of this valuable metal, a century ago, when Buffon supposed that the white gold or platinum was not an element but a compound of gold with iron; Bergmann, the Swedish chemist, succeeded in pointing out, in 1777, the elementary condition of the new useful metal. Platinum scales or laminæ are frequently covered with *rusty spots* from the iron, and this is removed by hydrochloric acid, as stated in the analysis. The above analysis may be taken as the average of several trials, because the commercial platinum ore is not regular in its composition. Several samples of the same ore, analysed in quantities of two grammes, gave results as follows:—

	A.	B.	C.
Gold	4·62	0·90	1·33
Platinum	65·22	71·21	75·03
Iridium	,,	9·23	3·22
Insoluble and osmiridium	9·61	8·13	10·15

Hence it follows, that Mr. Claus was right, viz., that an analysis of platinum ore should not be undertaken with less than ten grammes ($\frac{1}{3}$ ounce Troy).

For the *commercial valuation* I followed the method of Sobolewsky, as used at the Mint of St. Petersburgh. The gold having been separated by boiling in diluted aqua regia, the ore is dissolved in a mixture of three parts hydrochloric acid 25° B, and one part nitric acid 40° B, in the proportion of 10 or 15 parts acid to one part of ore. The result was—

Platinum	70·21	
Gold	3·97	
Not dissolved	8·83	being osmiridium and minerals.
Iron, copper, iridium, osmium, palladium, &c.	15·38	
Iron and copper	1·61	separated previously by hydrochloric acid.
	100·00	

It is very remarkable that the platinum appears in small circular or oval laminæ, like drops laminated or flattened, as if struck by a hammer; grains with crystalline facettes could seldom be distinguished. I call this very remarkable, because the gold of the same ore exhibits the form of *pepitas en miniature* or microscopic nuggets, or irregular grains; I saw some small globules and octahedric crystals. The platinum of South America has the same appearance.

In the residue, not dissolved in aqua regia, could be distinguished, as stated by Fremy, the *residu en grains* being the alloy of rhodium, osmium, iridium, and the *residu en paillettes* being iridium, ruthenium, rhodium, osmium. The other mineral constituents of this residue were grains or small pebbles of topaz, hyacinthe, ruby (?), diamond, quartz and feldspar.

It is unnecessary to dwell upon the industrial uses of platinum. I will, however, say a few words upon the metals associated with it, because they hold out the promise of many future useful applications, since Deville, at Paris, has taught the method of melting them. By aid of his lamp, platinum is easily melted. At the last Exhibition in Paris we admired the objects made from molten platinum by Savard, and since then attempts have have been made to employ it as a plating for copper for cheap chemical apparatus.

The temperature sufficient for melting 300 grammes (0·3 kilogrammes) of platina, melts 90 to 50 gram (0·04 to 0·05 kilogrammes) of rhodium.

The temperature sufficient for melting 100 to 150 grammes (0·10 to 0·15 kilogrammes), platina melts 10 grammes 0·10 kilogrammes) iridium, which was considered as perfectly infusible.

The iridium is commonly alloyed with platinum; the latter is then less attacked by chemical agents and is much harder, but can be hammered and laminated equally well. A large proportion makes the platinum more brittle.

During last year, M. Chapuis, at Paris, stated that rhodium, alloyed with platinum, formed a combination that could be hammered and laminated without difficulty, and that this combination had the excellent property of not being attacked by aqua regia, and thus the earnest wishes of the practical chemist are satisfied.

The American patent of Batchelder recommends alloying iridium with copper for etching purposes. If this be confirmed by experience there will be a new field opened for a useful application of it. The use of the iridosmine for the diamond pens, and of the rhodium for the same purpose, must not be omitted. It is said that one ounce of rhodium fetches in the United States from £2 10s. to £50 according to its purity.

I hope these notices may serve to demonstrate that the platinoid metals, scarcely known to the public, even by name, are very valuable substances, requiring further investigation with a view to future useful employment. The residue of the platinum ore, a few years ago of a very low value, scarcely £4 per lb. avoirdupois, has already risen in price, and is now saleable at four or five times that amount.

SOUTH KENSINGTON MUSEUM.

During the week ending 17th April, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,350; on Monday and Tuesday (free evenings), 3,703. On the three Students' days (admission to the public 6d.), 1,288; one Students' evening, Wednesday, 136. Total, 9,477.

Home Correspondence.

STEAM-SHIP PROPULSION.

Sir,—I had not purposed to take part in the discussion on Mr. M'Gregor's very interesting paper, read at your meeting on the 14th instant, but having been called upon I could not decline to contribute a few remarks, the expression of which, however, I now beg to amend. Referring to Griffiths's heart-shaped propeller blade, with the narrowest part at the extremity, as distinguished from the ordinary screw with the widest part at the extremity, I intended to observe, that, to have the maximum width at the exremity of the screw has been considered desirable, not, as reported, in order to gain power, but in order to apply the power advantageously by that portion of the propelling surface being the largest where the angle of the blade was supposed to be most favourable to effective propulsion. In prosecution of this idea, the great aim of many inventions has been to neutralize the centre part of the screw, doing the work entirely by means of the extreme portion: for example, some screws are merely flat discs, set at a given angle to the line of the vessel's motion, and fastened to radial arms, the central portion of the screw thus having no propelling effect whatever; and with the same object in view, a screw was designed by myself, with a pitch increasing from the centre towards the circumference, thus neutralising the centre and throwing the great portion of the work upon the extreme portions of the screw. These principles of construction are directly antagonistic to that of Mr. Griffiths. Woodcroft, again, increases the pitch fore and aft, and other screws have been made with both systems of increasing pitch combined; and yet no principle of construction whatever has hitherto been recognised as that which develops the power of the engine with the greatest dynamic effect. This deficiency of our knowledge now, in the twentieth year of the practical application of the screw, is doubtless attributable to the fact that no rule or formula, combining the mutual relations of displacement, power, and speed, as ascertained on trial of a ship, has yet been publicly received and recognised in the mercantile world, as a means of testing the comparative dynamic merits of ships. In fact, at the present day, the character of a steam-ship, as it respects its dynamic properties, is a mere matter of opinionative assertion or braggadocio, not based on any recognized rule involving the mutual relations of displacement, power, and speed that the vessel may, on trial, be found to realize. It has been to remedy this deficiency in marine engineering as a science that I have, for some time past, publicly, through the proceedings of the British Association and of the Society of Arts, and by aid of the *Artizan*, (which periodical has been liberally thrown open for public discussion on this important subject), promulgated the suggestion that great benefit would result to the public interests of the country if every steam-ship, before being taken off the hands of her builders, were put upon a test trial, with a view to her character, as respects dynamic merit, being judged of by the numeric coefficient

or index number resulting from the following rule, namely, Multiply the cube of the speed by the cube root of the square of the displacement, and divide the product by the indicated horse power, or by the consumption of coal per day expressed in cwts., the quotient being regarded as the index number, expressive of the dynamic merit of the ship, or as expressing the comparative dynamic merits of the various ships that may be tested by this rule. This, or any other analogous system of measuring constructive merit by the relative performances of the ships themselves, would give deep-thinking, but unobtrusive, tongue-bound, and personally retiring constructors some chance of attaining that public fame which is one of the rewards of merit, and which every man may laudably covet. The public are the great losers by public fame being denied to merit because unobtrusive, and consequently unknown or buried in obscurity. The merit of a constructor should be determined by the performance of his ship, rather than that the merit of a ship should be inferred, and taken for granted, from the personal performances of its constructor. These remarks have been suggested by a practical fact, which, in my various papers on steam-ship capability, I have before publicly referred to, and which I desire to take every opportunity of adducing and promulgating as evidence that steam-ship construction during the past 20 years has not been based on scientific principles, or even on inductive practice conducive to progressive improvement; but it has been in fact a mere "happy-go-lucky" speculation; and the singular fact to which I refer is this, that even at the present day, it is not prudentially safe for any steam-ship constructor to undertake a contract subject to the stipulation that the ship to be built shall, when tested by the rule above referred to, produce a coefficient or index number of dynamic performance equal to that which was produced by one of the first vessels to which the screw propeller was applied, namely, H.M. steam-sloop *Rattler*, which vessel, when immersed to a displacement of 1078 tons, and propelled by engines working up to 437 indicated horse-power, attained a speed of 9·64 nautical miles per hour, producing an index number of dynamic merit, calculated by the rule above enunciated, equal to 215·5. I admit that this index number of dynamic merit has, on several occasions, been surpassed by steamers of later date, but such performances are mere occasional events, not usually attained or definitely accounted for in such manner as admits of their reproduction being calculated upon with such certainty as to be made the subject of contract guarantee. Can such a state of things be regarded as scientific? Surely, steam-ship construction may be expected to embrace a definite realisation of speed with reference to displacement and power, before it can be regarded as a satisfactory development of science and art.

The extent to which private interests are occasionally ruined by the indulgence of injudicious chimeras as to steam-ship capability, and public interests sacrificed by the employment of vessels of a low order of dynamic merit, constitutes a national detriment of enormous magnitude. The shipping interests have it in their power, in great measure, to remedy this, simply by insisting on the dynamic merit of steam-ships being comparatively ascertained by some recognised formula, and regarded as one of the tests of the intrinsic value of ships, and by their affording to ship constructors statistical information as to the performances of ships at sea, whereby the best types of ships would thus become practically determined; the causes of excellence would be detected by comparison of the elements of construction; good ships only would then fetch a good price; constructive talent would be measured by the index number that may be earned by the actual performance. Excellence would thus be recognised, and meet its due reward.—I am, &c.,

CHARLES ATHERTON.

Woolwich Dockyard, 21st April, 1858.

Proceedings of Institutions.

Boston.—The seventh annual meeting of the members of the Athenæum was recently held, Thomas Garfit, Esq., president, in the chair. The attendance was larger than usual, and between 200 and 300 voting lists were sent in. The report of the committee for the past year states that the condition and progress of the Institution has, on the whole, been satisfactory—the members numbering nearly the same as at the last annual meeting—the financial position being favourable, and the entire Institution being in good working order in every department. The present number of members is 485. The classification of them, given as follows, shows that the Institution has the support of all classes:—Life members 6, members of parliament 4, clergymen 23, magistrates 12, professional gentlemen and bankers 30, hopkeepers 85, manufacturers and tradesmen (not being shopkeepers) 54, shopkeepers' assistants 30, clerks, &c., not in shops 60, country members 60, mechanics 25, schoolmasters and mistresses 16, innkeepers 7, independent gentlemen 20, youths under 21, 38, annual subscribers of one guinea 27, ladies 21. The gross income for the year, including a balance of £36 6s. 1½d. from the previous year, was £308 15s. 2d., and the expenditure £271 5s. 1½d., leaving a balance of £37 10s. 0½d. in hand. Lectures have been delivered by the following gentlemen; — Dr. Cammack, on the "Lays of Ancient Rome," by Macaulay; Herbert Ingram, Esq., M.P., on the "House of Commons;" and by the Rev. P. W. Clayden, on the Proverb, "Where there's a will there's a way." These have been well attended. Other lectures are in prospect. The number of London books had during the year is 420; the issues of the same amount to 5,096; of the Institution's own books (numbering 3,000), the issues were 5,902; and of newspapers and magazines 2,048; making an aggregate of entries amounting to 13,046. A new catalogue of the library has been published during the year. Votes of thanks were passed to the officers and committee, to the lecturers, to the guinea subscribers, and to the auditors. The following is a list of the new committee:—Mr. H. R. Gilson, Rev. P. W. Clayden, Dr. S. A. Cammack, Mr. J. W. Bontoft, Mr. T. Garfit, Mr. W. Garfit, Mr. J. F. Smyth, Mr. W. H. Adams, M.P., Mr. S. H. Jebb, Rev. G. B. Blenkin, Mr. A. Reynolds, Mr. Wise, Mr. F. T. White, Mr. W. E. Chapman, Mr. F. L. Hopkins, Mr. W. S. Greenwood, Mr. C. Wright, Rev. T. W. Matthews, Mr. T. Storr, Mr. G. F. Bayley, Mr. J. Noble, Mr. T. Fricker, Mr. J. M. Knowles, Mr. F. Wells, Mr. F. Cooke, Mr. J. Noble, jun., Mr. W. Gee, Mr. A. Spurr, Mr. T. Small, Mr P. W. Shout, Mr. J. H. Small.

Cheltenham.—Lectures have been regularly delivered during the winter, both to the members of the Literary and Philosophical Institution and to those of the Athenæum; and, though not in continuous courses upon a given subject, many of them have been of considerable value and interest. The liberal donation of £100, from Dr. Disney Thorpe, has helped materially to reduce the debt by which the former of these Institutions has long been impeded in its action; but the financial position, in each case, is still unfavourable. At the Athenæum, instruction classes have been satisfactorily organised, and very well attended.

Holbeck (near Leeds).—The evening classes in connection with the Church Institute were closed (with the exception of the drawing class) for the winter session, on the 25th of March. They have been better attended this session than in any previous one, showing that the benefits offered by this Institute to the working classes are appreciated. The Institute was established in October, 1855, for the sole benefit of the operative part of the community resident in the ancient part of Holbeck, and out of 142 members on the books, 130 are of the number of those who belong to the working classes.

The future prospects of the Institute are good; and there is no question but that, next winter, great progress will be made in all the classes.—The penny bank has been in operation for one year and four months, and the results are most satisfactory. 7,046 deposits have been received, amounting to £398 18s. 7d. The withdrawals, during the same period have amounted to £196 5s. 10d.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 26th March, 1858.

68. (2) Trade and Navigation Accounts (28th January, 1858).
142. Army Stores—Return.
155. East India (Stock Proprietors)—Return.
157. Cashel Election Petition—Report from the General Committee of Elections.
34. Bills—Edinburgh, &c., Annuity Tax.
39. Bills—Trustees Relief.

Delivered March 27, 29, 30, 31: April 1, 3, 8, 9, and 10, 1858.

125. East India (King of Oude)—Return.
140. Metropolis Roads (North of the Thames)—Returns.
153. Income Tax Returns (London)—Copies of Correspondence.
165. Emigration—Copies or Extracts of Despatches.
166. Chinese Prisoners (Hong Kong)—Return.
131. Customs Tariffs—Return.
163. Patriotic Fund—1st and 2nd Reports of Commissioners.
137. Water Companies—Return.
144. Australian Postal Service (Australian Mails)—Return.
145. Education—Return.
152. East India (Coinage, &c.)—Return.
170. London Mechanics' Institution—Report of Dr. Lyon Playfair.
98 (A I). Poor Rates and Pauperism—Return (A).
136. Revising Barristers—Return.
148. Highland Roads and Bridges—44th Report of Commissioners.
150. Coinage—Accounts.
151. Copper, &c.—Return.
154. Intoxication (Scotland)—Returns.
160. Westminster New Palace—Copies of Letters.
158. East India (Ameer Ali Moorad)—Correspondence.
167. East India (Nawab of Surat)—Correspondence.
27 (1). Navy Estimates—An Abstract and a Reprint of the Revised Votes.
117. Railway and Canal Bills—General Report of the Board of Trade.
118. Local Acts (21. Sunderland Dock; 22. North British Railway (Hawick and Carlisle Junction Railway); 23. Llanelly Harbour)—Admiralty Reports.
117. Railway and Canal Bills (79. Birmingham Canal Navigations; 80. Blackburn Railway; 81. Lancashire and Yorkshire and East Lancashire Railway Companies; 82. Lancaster and Carlisle Railway; 83. London and North Western Railway (Extension from Longsight) and (Additional Works) (No. 2); 84. London and North Western (Additional Works) (No. 1); 85. Manchester, Sheffield and Lincolnshire, and Great Northern Railway Companies; 86. Manchester, Sheffield, and Lincolnshire Railway (Garston to Liverpool); 87. Manchester, Sheffield, and Lincolnshire Railway (Station at Manchester); 88. Manchester South Junction and Altrincham Railway Nos. 1 and 2); 89. Oxford, Worcester, and Wolverhampton Railway; 90. Portsmouth Railway; 91. St. Helen's Canal and Railway; 92. South Wales Railway (Further Powers, &c.); 93 South Wales Railway (New Railway, &c.); Llanelly Harbour, Newport, Abergavenny, and Hereford Railway; 94. Warrington and Stockport Railway (Capital); 95. Warrington and Stockport Railway (Lease or Sale, &c.)—Board of Trade Reports.
41. Bills—Government of India (No. 2).
35. ——— Marriage Law Amendment.
37. ——— Medical Practitioners.
42. ——— Loan Societies.
Post Office—4th Report of the Postmaster General.
The "Cagliari"—Correspondence.
Public General Acts—Cap. 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Copies of the undermentioned Papers, presented by Command, will be delivered to Members of Parliament applying for the same at the Office for the Sale of Parliamentary Papers, House of Commons.

Railway Accidents—Report on, 1857.
Assessed Taxes—Cases determined on Appeal.
Births, Deaths, &c. (Scotland)—3rd Report of Registrar-General.
Turnpike Trusts—1st Report from Secretary of State.
Endowed Schools (Ireland)—Letter by Mr. A. J. Stephens.

Delivered April 13, 1858.

4 (1). Banks—Supplemental Return.
159. East India (Meerza Ali Akbar)—Correspondence.
171. Public Income and Expenditure (year ended March 31, 1858)—Account.
172. Exchequer Bills—Account.
36. Bill—Poor Rates (Metropolis).
The Excavations at Budrum—Papers.
The "Cagliari"—Appendix to the Correspondence.

Delivered April 14, 1858.

149. Metropolis Rates—Abstract of Returns.
156. Loan Societies—Abstract of Accounts.
171. Public Income and Expenditure (year ended March 31, 1858)—Account (a corrected Copy).
113. Harbour, &c., Bills (15. Clyde Navigation)—Board of Trade Reports.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Actuaries, 7.
Architects, 8. Mr. T. L. Donaldson, "Way-side Memoranda of an Architect during a tour in Ireland, more especially with reference to some of its peculiar ancient remains."
Geographical, 8½. I. Mr. William Lockhart, F.R.G.S., "On the Importance of Opening the Navigation of the Yang-tse-kiang, and the changes that have lately taken place in the bed of the Yellow River, &c." (2nd Part.) II. Mr. James S. Wilson, "Notes on his Journey in North-west Australia."

Tues.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Civil Engineers, 8. Mr. R. Jacomb Hood, M. Inst. C.E., "On Railway Stations;" and Prof. Airy, Hon. M. Inst. C.E., "Further Explanatory Observations on the Laying of Telegraph Cables."
Med. and Chirurg., 8½.
Zoological, 9.

Wed. ......Society of Arts, 8. Mr. J. A. Phillips, "On the Progress and Present State of British Mining."
Geological, 8. I. Mr. C. Bunbury, "On Fossil Leaves from Madeira." II. Mr. E. W. Binney, "On the Structure of Stigmaria Ficoides." III. Mr. J. W. Dawson, "On the Lower Coal-measures of British America." IV. Rev. T. Brown, "On some Sections of the Scottish Coal-measures." V. Mr. J. Morris, "On a species of Fern from the Coal-measures of Worcestershire."
Archæological Asso., 8½.

Thurs. ...Zoological, 1. Anniversary.
Royal Inst., 3. Prof. Tyndall, "On Heat."
Royal Society Club, 6.
Antiquaries, 8.
Royal, 8½.

Fri. ....London Inst., 8. Anniversary.
United Service Inst., 3. Capt. Schaw, "On Gunpowder as a Disruptive Agent."
Royal Inst., 8½. Prof. A. C. Ramsay, "On the Geological Causes that have influenced the Scenery of Canada, and the North-eastern Provinces of the United States."

Sat..........Royal Inst., 2. Annual Meeting.
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April 16, 1858.*]

Dated 12th March, 1858.

498. M. Smith, Heywood, Lancashire—Imp. in looms for weaving.
508. J. T. Coupier, Paris—Treating vegetable fibrous matters, to render them applicable for the manufacture of paper and pasteboard, and in apparatus connected therewith.

Dated 15th March, 1858.

526. J. Aked and J. Crabtree, Halifax—Imp. in the arrangement of machinery or apparatus for warping and beaming yarns for weaving.

Dated 20th March, 1858.

588. J. T. Pitman, 67, Gracechurch-street—Imp. in the manufacture of soap, and in the apparatus connected therewith. (A com.)
589. J. T. Pitman, 67, Gracechurch-street—Imp. in the mode of preparing and moulding clay into bricks, tiles, pipes, and other similar manufactures. (A com.)

Dated 22nd March, 1858.

594. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the metallization of objects for the electrotype or galvanoplastic process. (A com.)
598. J. Wright, 10, Alfred-place, Newington Causeway—An improved method of, and apparatus for, punching rolled metal plates and angle iron. (A com.)

Dated 24th March, 1858.

622. W. Wood and R. Wood, Radcliffe, Lancashire—Imp. in machinery or apparatus for spinning, doubling, and sizing yarns or threads.

Dated 25th March, 1858.

634. J. Young, Knaresboro'—Improved apparatus for signalling on railways by day and night.

Dated 26th March, 1858.

638. W. Moxon, J. Clayton, and S. Fearnley, Bluepits, Lancashire—Imp. in machinery for paying out electric telegraph cables, ropes, and other like articles.
640. J. Parkes, Birmingham—An imp. or imps. in eyelets.
642. R. M. Butt, Fairfield Works, Bow—Imp. in the manufacture of night lights.

Dated 27th March, 1858.

646. V. F. Jeanne and E. M. G. Martin, Paris—A machine for breaking stones.
650. J. Bushell and T. Wright, Manchester—Imp. which make grids for covering openings, through which fuel is deposited, in vaults or cellars, self-securing.
652. W. W. Eley, Broad-street, Golden-square—Imp. in cartridges.
654. J. A. V. Burq, Paris—Imp. in weighing machines.

Dated 29th March, 1858.

658. W. Garnett and C. Geldard, Low Moor, near Clitheroe, and J. Dugdale, Blackburn, Lancashire—Imp. in looms for weaving.
660. W. Chadwick, Bury—Imp. in the hoods or tops, and in the footsteps and bearings of ventilators.
662. J. Horton, Smethwick, Staffordshire—New or improved machinery to be employed in punching metals.
664. J. C. Durand, Pimlico—An imp. in the manufacture of chain cables.
666. G. Paterson, Glasgow—Imp. in apparatus for effecting the combustion of fuel and the consumption or prevention of smoke, applicable to boiler furnaces.
668. W. Davis, 11, George-street, Chick's-buildings, and T. Harper, Brewery-house, Broadplaines, St. Phillip's, Bristol—Imp. in apparatus for cutting soap.

Dated 30th March, 1858.

670. F. Robinson and E. Cottam, Pimlico—Imp. in hydrostatic and other presses.
672. W. Weallens, 12, Elswick-villas, Newcastle-upon-Tyne—Imp. in parabolic governors, and in the mode of applying the same to steam engines.
674. T. Steven, T. Reid, and T. Frew, Glasgow—Imp. in making moulds for casting.
676. W. G. Whitehead, Birmingham—A new or improved waterproof paper.
678. W. Oldfield, Skipton, and T. O. Dixon, Steeton, Yorkshire—Imp. in gas burners.

Dated 31st March, 1858.

680. J. Musgrave, jun., Globe Iron Works, Bolton-le-Moors—The application of the heat from the furnaces of singeing or dressing plates to generating steam and drying purposes, and imp. in the construction of such furnaces.
682. J. W. Duce, Wolverhampton—Imp. in locks and latches, and in attaching knobs to lock and latch spindles.
684. J. H. Whitehead, Royal George Mills, Saddleworth, Yorkshire—Imp. in making woollen bags.
686. J. Mercer, Cambridge, U.S.—Imp. in the manufacture of leather.
688. H. Napier, Hyde-road, Ardwick, Manchester—An improved process in the production of volatile oil of resin.
690. R. Peter, Dundee—Imp. in gill machinery for the preparation or manufacture of textile materials.

Dated 1st April, 1858.

692. A. Pelez, 9A, Mortimer-street, Cavendish-square—Imp. in hydraulic machines. (A com.)
693. E. A. Colette, Dieppedalle, near Rouen, France—Hashing meat with a mechanical chopping-board.
694. A. P. Dadley, New Hall-street, and N. Brough, Birmingham—An improved buckle or metallic adjuster for adjusting braces, belts, garters, and such like articles of dress.
695. F. R. Tavernier and J. A. F. Tavernier, 213, Rue Saint Dominique, St. Germain, Paris—Imp. in machinery for combing wool or other fibrous materials.
696. F. J. E. Oosterlinck, Paris—An improved valve or plug for the passage of water or other fluids.
697. H. Ward, Hamburg—Improved machinery for expressing liquids from organic substances.
698. W. E. Newton, 66, Chancery-lane—Improved machinery for manufacturing corks. (A com.)
699. H. Bentley, Horton, near Bradford—Certain imp. in machinery or apparatus employed in preparing and spinning worsted and other fibrous substances.
700. T. Boardman, Pendleton, and J. Allcock, Stockport—Imp. in looms.
701. C. G. Russell, Manchester—Imp. in machinery or apparatus for printing.
702. T. F. Robinson, Halifax—Imp. in apparatus for cutting cork.

Dated 3rd April, 1858.

703. T. Greenshields, 11, Little Titchfield-street—Imp. in treating ammoniacal liquor produced from coal in making gas and obtaining useful products for making artificial manure.
705. V. Gache, senr., Nantes, France—An imp. in the construction of steam engines for the use of vessels.
706. A. Pelez, 9A, Mortimer-street, Cavendish-square—A new steam piston for horizontal and vertical engines. (A com.)
708. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in ships' propellers. (A com.)
709. C. Tress, Blackfriars-road—Imp. in or applicable to the class of hats made from palm leaf, grass, chip, Tuscan, Leghorn, Panama straw, and other like materials.
710. J. Fowler, junr., 28, Cornhill—Imp. in apparatus used when ploughing, tilling, or cultivating land by steam power.
711. W. Crowley, Newport Pagnell—Imp. in combining and working ploughs.
712. D. Morrison, Birmingham—Imp. in boiling oils.
713. H. Cartwright, Dean, Broseley, Shropshire—Imp. in the construction of excentrics and in the mode of working them when applied to steam engines.
715. S. Minton and R. H. Thomas, Clough Hall Collieries, Staffordshire—An improved construction of battery.
716. R. Targett, Windmill-street, Finsbury—Imp. applicable to lamp-glasses or shades.
717. A. V. Newton, 66, Chancery-lane—Imp. in machinery for cutting veneers. (A com.)
718. J. Stobbs, Sydney-street, and G. R. Hall, Linskill-street, North Shields—Imp. in pumps for raising water and other liquids.

Dated 5th April, 1858.

719. W. Clark, 53, Chancery-lane—An improved construction of water tank for ships and other vessels, and mode of applying the same on board a vessel, whereby it is capable of conversion into a float for saving life and property in case of the foundering of the vessel. (A com.)
721. J. C. Dieulafait, 2, Rue Sainte-Appoline, Paris—An improved method of manufacturing garments, whereby one garment may be changed in form to that of several others.
723. R. C. H. Groombridge and H. Groombridge, 5, Paternoster-row, and J. Musselwhite, 19, Aldersgate-street—Imp. in a black-board and apparatus for teaching music.
725. O. Sarony, Scarborough—Imp. in producing photographic portraits.

Dated 6th April, 1858.

727. W. B. Webster, Adam-street—An imp. in making of butter.
729. E. Owen, Blackheath—Imp. in the manufacture or production of artificial fuel, and in the application of the same to metallurgical purposes.
731. R. Hornsby, junr., Spittlegate Works, Grantham—Imp. in ploughs.
733. H. Schwietzer, J. Holder, and J. Broughton, Scarp Castle, Brighton—Concentrating and retaining the valuable properties of farm yard and stable manure.
735. D. Davy, W. Bentley, and J. Davy, Bradford—Certain imp. in looms employed for weaving.
737. J. Sangster, Newington—Glazing in wood without putty.
739. R. H. Collyer, Marylebone—Imp. in the manufacture of paper. (A com.)

Inventions with Complete Specifications Filed.

749. E. Foster, Connecticut, U.S.—A new and useful or improved life-preserving berth for navigable vessels.—7th April, 1858.
752. S. O. Mason, Connecticut, U.S.—Certain new and useful improvements in door hinges. (A com.)—8th April, 1858.
753. E. Richmond, Massachusetts, U.S.—Certain new and useful mechanism for reducing, or reducing and crushing, and in various other respects treating grain, sugar cane, tobacco, or other substance or substances. (Partly a com.)—8th April, 1858.

WEEKLY LIST OF PATENTS SEALED.

April 16th.

2648. D. Guthrie and J. Vavasseur.
2657. J. Bentley.
2659. J. Eastwood.
2660. R. A. Brooman.
2664. L. De Cristoforis.
2666. J. Schmidt.
2672. H. Wimball.
2675. W. Bentham.
2706. A. V. Newton.
2736. W. Clark.
2750. W. Padgett.
2770. L. de Landfort.
2778. J. L. Norton and E. Wilkinson.
2862. H. Bessemer.
2912. T. F. Brabson & G. Hughes.
42. J. A. M. Chaufour.
284. P. Molinari.
370. W. K. Foster.

April 20th.

2681. G. H. Smith.
2684. C. Tooth and W. W. Wynne.
2689. R. Duke.
2691. J. Bethell.
2696. J. Milne.
2699. J. Smith.
2704. W. H. H. Akerman.
2772. J. J. Schuessel and P. J. Thouret.
2775. P. B. Kyishogloo.
2782. M. F. Isoard.
2783. C. Iles.
2837. T. Rowcliffe.
2897. W. Smith.
237. C. Askew and D. Ritchie.

Patents on which the Stamp Duty of £50 has been Paid.

April 12th.

816. J. Templeton.
858. J. Lawson and S. Dear.

April 15th.

863. J. Cowley and D. P. Sullivan.
841. P. A. Devy.
849. H. Woodhouse.
1045. G. Taylor.

April 16th.

845. E. E. Allen.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4078	April 17.	Improved Roof Lamp	T. Truss	Chester.
4079	„ 20.	Improved Spring Mattress for ensuring Purity of Air and Ventilation	W. M. Staunton	Birkenhead, Cheshire.

Journal of the Society of Arts.

FRIDAY, APRIL 30, 1858.

EXAMINATIONS.

The following letter has been received, in reply to a request made by the Council to Lord Derby, that his Lordship would place at their disposal nominations to compete for Clerkships, and other Government situations of a similar character, as rewards to successful candidates at the Society's ensuing Examinations:—

Treasury, S.W., 28th April, 1858.

Sir,—Lord Derby has communicated to me the request of the Society of Arts, made through you, that a certain number of nominations to appointments under his Lordship's control may be placed at the disposal of the Society, and I beg to inform you that, in accordance with the wishes expressed by the Society, Lord Derby will be prepared to nominate four candidates during the present year, to compete for such clerkships and other similar situations as may fall to his Lordship's disposal.

I shall be obliged, therefore, if you will have the goodness to inform me, at your convenience, of the names and addresses of the four candidates whom the Society would desire to recommend, in order that their names may duly be recorded as desirous to compete for appointments.

I am, Sir,
Your obedient servant,
WM. G. HYLTON JOLLIFFE.

The Secretary of the Society of Arts.

THE SOCIETY'S CONVERSAZIONE AT THE SOUTH KENSINGTON MUSEUM.

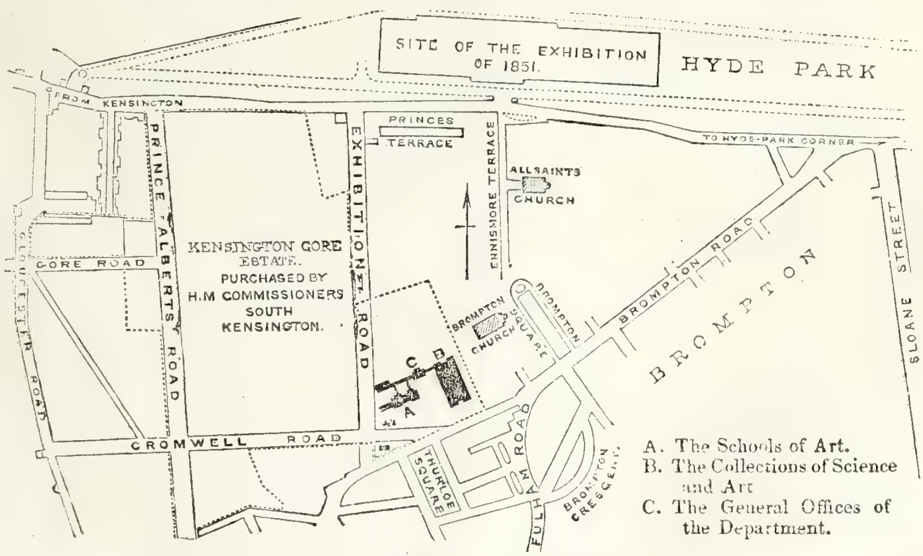
Members are requested to take notice that the next Conversazione will be held at the South Kensington Museum, on Saturday, the 8th of May. The doors will be opened at 8 o'clock.

The following divisions of the Museum will be lighted on this occasion:—

1. The Sheepshanks Gallery of Pictures.
2. The Sculpture Gallery.
3. The Architectural Museum.
4. The Animal Produce Collections.
5. The Ornamental Art Collections.
6. The Structure and Building Materials Collections.
7. The Educational Collections.
8. The Collection of Patented Inventions.
9. The Photographic Society's Exhibition.
10. The Art Training Schools.

Carriages are to set down at the refreshment entrance. The band of the Royal Horse Guards (Blue) will be in attendance.

The following plan shows the position of the new Museum at Kensington.



TENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 5th instant.

The Exhibition will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members, by ticket, or written order bearing their signature, may admit any number of persons. The number of visitors up to yesterday, the 29th inst., was 3,782.

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty Local Boards have been formed. Returns of the Candidates who have passed the

Previous Examination have been received, as follows:—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	23
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No. 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	18
Halifax, No. 1.	15
Salisbury	1
Sheffield	18
Liverpool	35
Lockwood	1
Halifax (Working Men's College), No. 2.	21
York	7
Berkhampstead	19
Bristol	11
London Domestic Mission	1
Royal Polytechnic Institution	28
Birmingham, No. 1, Messrs. Chance's Reading Room	2
Sheerness	1

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

T. D. Acland, Member of Council	£ 5	5
The Rt. Hon. C. B. Adderley, M.P.	5	0
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	£ 2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P., Vice-Pres.	10	10
Lieut.-General Sir Charles Pasley, K.C.B.	5	0
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

CONVERSAZIONE.

The first Conversazione of the present Session was held on Saturday evening last, at the Society's House. The whole of the rooms were thrown open, and in the great room was displayed a series of upwards of sixty drawings of curious modes of marine propulsion, which had been prepared and were kindly lent by Mr. J. MacGregor.

In addition to the above, a collection of models, illustrative of the same subject, and patented between the years 1794 and 1850, were kindly lent by Mr. Brunet, the surviving partner of the late firm of Seaward and Co., and from the Museum of the Commissioners of Patents at Kensington. Mr. Tomkins kindly attended, and exhibited, by the aid of one of Ross's finest microscopes, the Infusorial Animalcules alluded to by Mr. MacGregor in his Paper "On the Paddle Wheel and Screw Propeller," read before the Society on Wednesday, the 14th inst.

In the Great Room was also arranged an historical series of Telegraphs, including Wheatstone's first Six-line Wire Needle Telegraph, and the needle instruments at present in general use; Wheatstone's Magneto-Electric Dial and Capstan Instruments; Baines's Chemical Telegraph; E. Highton's Single Needle Instrument; M. E. Henley's Magnetic Needle Telegraph; Siemen's and Halske's Induction Relay, their Magnetic Dial Instrument, and their Recording Instrument for Submarine Lines, as well as Mr. Varley's Instrument, worked in connexion with the Dutch Cable Line. The instruments were in operation during the evening. Messrs. Newall exhibited a collection of the various Electric Telegraph Cables hitherto laid. Mr. James Winter, jun., exhibited his Locomotive Engine for common roads, called the "Steam Horse," which is stated to possess considerable power of ascending inclines. In the Committee Room was also a Model of the New Life Boat recently adopted by the Shipwreck Institution, as well as a unique specimen of Double Refracting Iceland Spar, by Professor Tennant. The Exhibition of Patents in the lower rooms was thrown open.

The thanks of the Council are specially due to those gentlemen who kindly contributed their models and specimens on this occasion.

TWENTIETH ORDINARY MEETING.

WEDNESDAY, APRIL 28, 1858.

The Twentieth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 28th inst., Thomas Sopwith, Esq., M.A., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Addis, William	Cormack, John Rose, M.D.
Ashton, Thomas J.	Lewis, John Frederick

The Paper read was—

ON THE PROGRESS AND PRESENT STATE OF BRITISH MINING.

By J. ARTHUR PHILLIPS.

The metals sought by the miner usually occur in combination with either sulphur or oxygen, or their oxides may themselves be combined with an acid, giving rise to carbonates, phosphates, sulphates, &c. In this state they are said to be mineralised, and the unproductive substances with which they are associated are known as the matrix or gangue. When such a mixture contains a sufficient proportion of mineral to enable it to be advantageously treated, it is known as an ore of the metal which it contains.

Metalliferous ores are derived either from veins or beds, but gold, and the finer descriptions of oxide of tin, are chiefly obtained by washing certain alluvial deposits, consisting of the *débris* of veins yielding these metals.

Veins or lodes have been defined, by Werner, to be "mineralised repositories of a flat or tabular shape, which traverse strata, without regard to their stratification, having the appearance of rents formed in the rocks, and afterwards filled up with mineral matter, which differs, more or less, from the rocks themselves."

The most important ore occurring in beds is ironstone. This is frequently found interstratified with the coal, sandstones, and shales of the coal measures, and preponderates in value over every other mineral deposit worked in this country.

The methods of working these several forms of deposit, and the subsequent preparations of the ores obtained, have from time to time received various modifications and improvements, and these will form the chief subject of the present paper.

It would appear that silver and gold were known to the Britons before the Roman invasion, since coins of these metals were in circulation among them before the arrival of Cæsar. Cæsar and Strabo both state that the Britons obtained their copper from foreign countries, from which it may be inferred that the art of refining this metal was but little cultivated by our forefathers at that remote period. Iron is described by Cæsar as being so rare in Britain that pieces of it were employed as a medium of exchange; but, a century later, it had become exceedingly common, since in Strabo's time it was an article of exportation.

Tin was anciently, however, the most celebrated metallic product of Britain, and appears to have been obtained in considerable quantities, since it was the desire of obtaining possession of the tin mines, and thereby becoming independent of the Phœnician monopoly, which first induced the Romans to visit this island.

Before the conquest of their country, the ancient Britons extracted tin from its ores by methods which they had themselves discovered, and which were probably improved by their conquerors. The broken and rudely-washed ore was placed in a hole cut in the ground, the sides of which were lined with fuel, and this being ignited, reduced the metal, which was run off into an outer receptacle. Many of these rude furnaces have been discovered in various parts of Cornwall, in which not only charcoal and slags have been found, but also portions of reduced metal, which, in some instances, from long exposure to oxidising influences, have again become partially converted into peroxide.

The remains of these ancient establishments are known by the name of "Jew's Houses," and, a short time since, a remarkable relic of this description was found buried beneath a stratum of peat, twelve feet in thickness, at Redmoor, in the parish of Luxullian, Cornwall.

At this place, in addition to a considerable amount of metallic tin, more or less oxidised, on the exterior, large quantities of imperfectly fused scoriæ, mixed with imbedded charcoal and metallic globules, were discovered. A Romano-British fibula, some stone arrow-heads, a piece of bronze, a wooden shovel, and another shovel of wood tipped with iron, were also found, together with a fragment of an earthen "tuyere," and numerous blocks of peat, which had evidently been collected for the purpose of being employed as fuel by the ancient smelters, and had subsequently become covered by a deposit of the same material.

A large proportion of the objects found in this locality will be found lying on the table.

The form of bellows employed in these rude smelting works cannot now be determined, but two very simple methods of obtaining a current of air for such purposes are given in the diagrams on the walls of the room. The first of these represents bellows, from an Egyptian painting after Rosellini. The men are here represented as blowing a charcoal fire, to each side of which is applied a pair of bellows. These are worked by the feet, the operators standing upon and pressing them down alternately, whilst they pull up each exhausted skin by means of a string held in the hand. The second diagram represents the bellows employed for the manufacture of wootz, by the natives of India.

Another ancient smelting establishment, found in the same neighbourhood, was probably of a much more recent date, since not only were some portions of the stonework still remaining, but the slags were more completely fused, and entirely free from any admixture of metallic globules. These slags, of which specimens will be found on the table, were found, on analysis, to have the following composition :—

Silica	40·60
Alumina	19·22
Oxide of tin	22·95
Protoxide of iron	7·31
Sulphide of iron	9·04
Lime	traces
Potash	1·00
	100·12

In this place there were also discovered some tobacco pipes and a coin of Charles I.

Previous to the time of Charles no attempt had been made to effect the smelting of tin by means of pit coal; but, at this period, some unsuccessful experiments were undertaken by Sir Beville Grenville, of Stow, in the county of Cornwall. No satisfactory results were, however, obtained until the second year of the reign of Queen Anne, when a Mr. Liddell, of Bodmin, who was associated with Mr. Moult, at that time celebrated as a chemist, obtained a patent for the reduction of tin ores in a blast furnace, by means of fossil fuel. The invention of the reverberatory furnace soon followed this discovery, and this apparatus, slightly modified in form and dimensions, is that employed by the tin smelters of the present day.

The alluvial tin deposits of Cornwall have been worked from the remotest antiquity; but during the last three centuries the larger proportion of ore produced has been derived irom workings on lodes.

The produce of these, in 1800, was 2,522 tons; in 1810, 2,036 tons; in 1820, 2,990 tons; in 1830, 4,444 tons; and in 1855, 6,000 tons of black tin. Tin ore, or black tin, usually contains about 70 per cent. of metal.

One of the oldest mines in Europe, producing large quantities of copper, is that of Rammelsberg, near Goslar, in Lower Saxony, the records of which have been traced back to the tenth century. The celebrated Swedish mine of Fahlun, commenced in the twelfth century, afterwards entered into competition with Rammelsberg, and afforded large quantities of ore. The mines of Thuringia were opened in the thirteenth century, and, together with others of less note, situated in various parts of Germany and Sweden, supplied for some years the wants of a large portion of the civilised world.

Cumberland is known to have produced copper in the thirteenth century, as it is shown, by records still preserved, that rich veins of this ore were worked at Newlands, near Keswick, in the year 1250. It is also evident, from a charter granted by Edward IV., A.D. 1470, to the town of Keswick, that it was at that period the seat of extensive copper works. In Camden's time these works were re-opened, but afterwards destroyed, and the miners killed in the civil wars.

Copper was also produced in considerable quantities at Ecton Hill, in Staffordshire, before its discovery in Cornwall, since Dr. Pot, who wrote in 1686, speaks of the copper mines as having been wrought long previous to that date.

The Pary's mine, in Anglesea, is supposed to have been first opened by the Romans, and became exceedingly productive about the year 1773; and, during the twelve succeeding years, produced such large quantities of copper ore as to reduce, in a very considerable degree, the price of that metal throughout Europe. Subsequently to this date the produce of the Anglesea mines began rapidly to decline, and, in 1799, the Pary's mountain had become almost exhausted.

Systematic explorations for copper were probably commenced in Cornwall about the year 1700. At first the annual amount of ore raised was very limited, as several causes operated to restrict this branch of industry.

The machinery employed was inefficient, and unfitted for removing large quantities of water from considerable depths. The royalties, or lord's dues, were also usually exorbitant, amounting to one-eighth, one-seventh, and even one-sixth of the gross produce of the mine, whilst the smelters, on the other hand, compelled the miners to accept such prices for their ores as they thought fit to determine. With the improvement of pumping machinery and a more liberal scale of royalties, the annual production of copper ores in Cornwall has now reached nearly 200,000 tons, and there is but little doubt that the yearly produce of this metal will steadily increase. The average yield of Cornish copper ores may be taken at about $6\frac{3}{4}$ per cent.

A work entitled "A Just and True Remonstrance of His Majesties Mines Royall to His Majestie," published in 1641, affords a tolerable idea of the state of lead mining in this country at that period. This volume consists of a series of letters, or rather memorials, addressed to the King (Charles I.), the Prince of Wales (afterwards Charles II.), and the Privy Council, by Mr. Bushell and others, interested in the "mines royall" of Cardiganshire, praying for the extension of the lease, the employment of convicts in the mines, and the liberty of cutting peat and turf for the purpose of smelting the ores.

Sir John Pettus, who published his "Fodinæ Regales" in 1670, remarks, while treating on the mines of Cardiganshire, "The chief mines which produce silver now in working (though not effectually), are those at Coomsumblock and the Darren Hills, Cogincau, Tallabont, Coomustwith, Tredole, Thruscott and Rossovawre, which were the old Roman works, near to which are conveniently placed the smelting and refining mills, all which are in the townships of Skibery Coed, in the parish of Llanny Hangell, Genne Glyme, and in the County of Cardigan, *alias* Shire Abertivy."

The ores furnishing lead are more uniformly distributed in this country than those of copper. About 330 lead mines are now making returns, and at least 400 may be estimated to be in operation, although the total produce of this metal has, of late years, experienced but slight increase. A large quantity of British lead ore contains a valuable amount of silver. The richest ores are produced in Cornwall, and yield, on an average, about 23 ozs. of silver per ton. The mines of Alston Moor, Weardale, and Teesdale, afford lead yielding from 6 to 12 ozs. of silver per ton, Derbyshire and Shropshire lead contains from 1 to $1\frac{1}{2}$ oz. per ton, and the mines of Flintshire and Denbighshire yield lead averaging from $4\frac{1}{2}$ to $6\frac{1}{2}$ ozs.

The nett consumption of pig lead in our home manufactories, for eight years ending 1855, averaged nearly 55,000 tons per annum. The price of this metal has experienced great fluctuation during the present century. From 1806 to 1815, it averaged £27 12s. per ton; from 1816 to 1825, £21 18s. 6d.; in 1830, the price had declined to £12 10s; whilst, at the present time, it may be taken at £22 10s. In 1796, the make of iron in this country amounted to 125,000 tons; in 1806, to 250,000 tons; in 1820, to 400,000; in 1827, to 700,000; and in 1855, to nearly 3,300,000.

Coal was not generally employed as fuel until the beginning of the reign of Charles I. It is, however, mentioned in documents anterior to the reign of Henry III., for that monarch, in the year 1234, renewed a charter granted by his father to the inhabitants of Newcastle, who were permitted to dig for coal on paying an annual tax of £100. That this fuel had been introduced into London before 1306 is proved by the fact that in that year its use was prohibited from the supposed tendency of its smoke to "corrupt" the atmosphere.

The coal-fields of Colliery, near Lanchester, were first opened in the year 1330; those at Merrington and Ferry Hill, in 1343, and those of Gateshead, Wickham, and Tynemouth, in the year 1500. The coal-fields of the United Kingdom have been estimated to contain an area of 12,000 square miles. The present vend of coal is about 5,500,000 tons per month. This is obtained from 2,700 collieries.

The annual yield of our mineral products now amounts to £35,000,000, and any estimate of the value which this sum ultimately assumes after the metals have been subjected to more or less complicated elaboration, must be merely hypothetical.

Mining Operations.

Sett, &c.—It being impossible to compress within the limits of a single paper even a very brief sketch of all the various systems of mining resorted to in this country, I shall confine my observations to the method employed for the working of mineral veins, and endeavour succinctly to trace the operations of the miner from the time of selecting a piece of ground for exploration up to the period of his forwarding his dressed ores to market. Whilst doing this, I shall also point out some of the more striking improvements which have been introduced, and direct attention to the direction from which further advantages may be anticipated.

The minerals of Great Britain do not, as in many continental countries, belong solely to the crown, but are generally the property of private individuals. The mineral and surface rights are, moreover, not always united, and, consequently, the mineral lord may be in receipt of an income from mining operations, whilst the surface pro-

prietor, whose land is destroyed, receives little or no compensation.

In most of our mining districts the veins cannot be explored without the express consent of the proprietor, but in certain exceptional localities they may be attacked without any special license or authorisation. In such cases tradition and custom constitute the acting covenants, and necessitate each individual miner to become a conservator of the general privileges.

The consideration given for the right of exploring the contents of a vein is usually a fixed proportion of the value produced, rendered either in kind or money, and technically known as royalty. This is secured to the lessor by a lease, which embraces a variety of covenants with the lessee relative to the management of the property, and which remains in force during a stated number of years.

The operations of the lessee are confined within certain specified limits, called a Sett, within which, subject to various restrictions, he may work as he thinks proper. Previous to obtaining a lease, the miner sometimes works under what is called a take-note, extending over a period of one or more years. This document is more simple than a lease, and its cost comparatively trifling.

Shoding.—When a piece of ground has been selected, and a take-note or lease been obtained, the operations of the miner are usually commenced by what is known as shoding or costeaning. This consists in sinking a series of pits from the surface to a short distance in the shelf or rock, in a direction as nearly as possible at right angles to the presumed run of the lodes in the locality. These pits, being connected with each other by means of galleries from their bottoms, will necessarily discover the backs of any veins or lodes that may be traversing the property.

When sufficient inducement for the further prosecution of the work has been discovered, the ground is either explored by an adit-level, or by shafts, crosscuts, and levels.

An Adit Level consists of a gallery driven in from the lowest available ground within the limits of the sett, and may be either directed on the course of one of the principal lodes, or so as to intersect the different veins at a more or less considerable angle. The first method, where practicable, possesses the advantage of exploring a considerable length of the vein, on the direction of which the level has been extended, and affords facilities for intersecting a number of parallel lodes by means of cross cuts, whilst, by the second, the whole of the veins contained in the sett may be frequently intersected.

A large amount of both money and time, are, however, often squandered in resorting to drainage by means of an adit level. Whatever facilities the locality may afford for this system of drainage, it is never prudent to resort to it if its cost will much exceed that required for the erection and maintenance of machinery to secure the same object. For this reason long shallow adits, a few fathoms only below the surface, are seldom to be recommended, since, to explore the ground to any considerable depth, machinery must generally be erected, and when this is done, the cost of raising water an additional ten or fifteen fathoms is but trifling. An adit level usually affords drainage to a very limited extent, and possesses few advantages beyond saving the cost of raising water from its point of intersection with the lode to the line of surface. When once this depth, and the quantity of water are known, the cost of the necessary machinery, and the expense of pumping can be approximately determined, and if these be compared with the expenditure incident to the driving of a level, the relative advantages of the two systems in both time and money become apparent.

Shafts.—When the employment of shafts has been determined on, it is of the greatest importance to the success of an undertaking to choose eligible sites for these works, since they not only constitute the highways to and from the various horizontal galleries, but also afford the necessary facilities for unwatering the mine, and removing its produce. Where extensive permanent operations are contemplated, vertical shafts are generally to be preferred, especially when large lifts of pumps are to be placed in them, but in the case of commencing preliminary trials, it often becomes a question worthy of careful consideration, whether a saving of both time and money may not be effected by the use of underlie sinkings. Apart from ventilation and pumping, shafts are only used for winding and climbing, and for the latter purpose inclined are preferable to vertical shafts. The drawing of stuff through inclined shafts was formerly attended with considerable inconvenience and expense, since no efficient means had been adopted for the prevention of friction and strain. These evils have of late years been obviated by the introduction of a kind of guide rail from the mouth to the bottom of the shaft. This may be constructed either of wood or iron, whilst the kibble should be not only provided with wheels to run on the rails, but should also have anti-friction rollers, so arranged as to retain it in its proper position during its passage through the shaft. The form of the kibble employed should be such as to admit of its being readily filled and emptied. Where these appliances are adopted, the cost of drawing through underlie shafts is not found to exceed that of hauling through vertical ones, whilst in many instances the difference of the cost of sinking is exceedingly great.

Levels on the Courses of Lodes.—Pryce, who wrote his "Mineralogia Cornubiensis," in the year 1778, states, that at that period the vertical distance between levels averaged about eight fathoms, but since that time it has been increased to ten, and, in some instances, twelve fathoms. There does not, however, appear to be any valid reason for adopting uniformity of distance between such drivages, since this should rather depend on the nature and character of the lode than on any arbitrary custom. When lodes are large and contain short lenticular bunches of ore, as in the case of many of the German mines, a less distance than ten fathoms may be advantageous, but in the case of veins presenting considerable uniformity of composition, distances of even fifteen fathoms might sometimes be adopted with advantage. The drivage of levels at short distances from each other must necessarily entail a heavy expense on an undertaking, and, consequently, this portion of mining cost should be carefully economised.

Winzes and Stopes.—Winzes are shafts sunk between two levels for the purpose of connecting them, but without communicating with the surface, and are employed for forwarding ventilation, and many other purposes. When a shaft is sunk or a gallery excavated in hard rock, there is but little difficulty in making it retain its original form, but should the ground be soft, and consequently offer but little resistance to pressure, artificial means must be adopted for its support. This is most frequently effected by means of wood, although, in some instances, walls of brick or stone are employed for that purpose.

The ores existing in a vein are, to a certain extent, extracted in cutting the longitudinal galleries excavated in it, but, as these are situated at considerable distances from each other, the ore thus raised forms but a very inconsiderable part of the produce of the lode. In order, therefore, to obtain the minerals between the different levels, the ore is worked out and the space afterwards filled in with rubbish arising from the other operations of the mine. This operation is called stoping.

Methods of Attacking the Rock.—The tools employed by the miner necessarily vary in accordance with the nature of the rock which he has to traverse. If the ground be soft, nothing but an ordinary pick and shovel is employed; if it be somewhat hard, and contain numerous fissures, he has recourse to the use of steel wedges, called "gads," by driving which into the crevices of the rock he is enabled to split off larger portions than he could by the use of the pick alone. When

the ground to be cut through does not admit of being thus broken, the work is effected by the assistance of gunpowder.

Before this can be employed, it is necessary to bore a hole into the rock for its reception, which is done by means of a bar of steel, armed with cutting edges. Instead of using a steel bar, one of iron, furnished, at one of its extremities, with a steel point, is sometimes employed. To use this instrument, one of the workmen holds the sharpened end of the borer to the rock, whilst another hits the other end a heavy blow with a large hammer or a mallet. As the hole deepens, the person who holds the tool turns it a portion of a revolution between each blow, and in this way a deep hole is ultimately obtained. The borer is, from time to time, during the operation, removed from the hole for the purpose of taking away the broken rock or sludge, and a little water is added for the double purpose of cooling the borer and facilitating its action. When the hole has attained a sufficient depth, which necessarily varies with the nature of the rock operated on, it is carefully cleaned out with what is called a swab-stick, and a proper quantity of gunpowder deposited at the bottom. For the purpose of confining this, and thereby giving force to the explosion, the hole is now filled up by ramming in a quantity of soft schist called "tamping;" a small hole being left by the introduction of a copper needle, which is subsequently removed to afford means for exploding the charge when required. This is done by means of a reed or rush, filled with fine powder, and to which a slow match is attached, during the burning of which the men have time to escape out of the reach of the fragments of rock projected by the explosion. Within the last few years, however, this method of blasting has, in this country, become almost entirely superseded by the use of the "patent safety fuse," which itself not only acts as a slow match, but has also the advantage of being safer and more readily employed, since, with it, the copper needle is no longer necessary, the fuse being placed in the hole before it is closed, and the tamping forced in around it.

When the rock in which a hole has been bored is damp from infiltration of water, the powder is enclosed in a waterproof bag before being introduced into the cavity.

Pumping Machinery.

From the large quantities of moisture constantly percolating through the strata, all the workings of a mine below the adit level would quickly become filled with water if some means were not adopted for its removal, and, for this purpose, numerous and frequently very complicated machinery has, at various periods, been made use of.

The most simple and earliest employed method of removing the water from a shaft, is doubtless by means of a bucket and cord set in motion by manual labour or horse-power, although, on referring to the works of Agricola, who wrote about the year 1530, we find that pumps of various descriptions, set in motion by water-power, were then in very common use for mining purposes.

We are informed by Mr. Bald, in his "Coal trade of Scotland," published in 1812, that in 1890 water-wheels and chains of buckets were commonly employed to drain the collieries in that country. The axle of the wheel extended across the pit's mouth, and small carriers were fixed upon it to receive endless chains, consisting of two or three tiers which reached down to the coal. To these chains were attached wooden buckets or troughs fixed in a horizontal position, which circulated with the chains ascending on one side and descending on the other, filling at the bottom and discharging at the top, as they turned over the wheels of the axletree. This apparatus was subject to the inconvenience, that whenever a joint gave way, the whole set of chains fell to the bottom, and every bucket attached to them was splintered in pieces by the fall. When water could not be procured, the same sort of machinery, upon a smaller scale, was worked by horses.

In 1708, windmills were erected to work pumps on several collieries in Scotland, but, being ineffective in calm weather, never came into general use. Savery, about the year 1696, was probably the first to employ steam-power for the raising of water to a higher level.

In Savery's engine, a vacuum was formed in the receiver by the condensation of steam; water was then forced into it by the pressure of the atmosphere, and elevated to any required height by the direct action of steam on its surface. This inventor was the first to employ the term horse-power. His apparatus was ultimately superseded by Newcomen's atmospheric engine, introduced about the year 1705. The construction of this machine differed widely from Savery's arrangements, inasmuch as the steam exerted no direct influence on the surface of the water to be elevated, but was only employed as a means of forming a partial vacuum beneath a piston attached to one end of a lever, whilst the pump rod was in connection with the other. In this way atmospheric air performed the principal duty, whilst steam was merely used as a means of removing the air from beneath the piston. To this engineer belongs the credit of introducing the beam or balance lever and the method of condensing steam, and forming a vacuum by immediate contact with cold water.

The various cocks and valves of this apparatus were at first opened and closed by the hand of an attendant, until Humphrey Potter ingeniously connected them with the beam by means of strings and catches. This arrangement was subsequently improved on by Mr. Henry Beighton, who employed the plug rod and hand-gear; which, with but slight modification, is that used at the present day. This gentleman was also the first to adopt the steelyard safety-valve.

Two of Newcomen's engines were, at an early period, erected at Wheal Busy, near Chacewater, with cylinders respectively 66 and 72 inches in diameter. The consumption of coals by these two machines amounted to 320 bushels, or about 13 tons daily.

In the year 1766, the attention of Smeaton was first directed to improvements in steam machinery. With an experimental engine of one-horse power, he evaporated $6\frac{1}{4}$ lbs. of water by 1 lb. of coal, and produced the best effects with a pressure of 8 lbs. above that of the atmosphere. In 1775, he erected a 72-inch atmospheric engine at Wheal Busy. The stroke of this machine was $10\frac{1}{2}$ feet, the cylinder being placed over the boiler, and the main-beam composed of several pieces of wood bolted together, and provided with **D** ends. The highest duty performed by this apparatus was 9,450,000. By enclosing the fire, and supplying the fuel through a tube, this engineer was able to evaporate 7.88 lbs. of water with 1 lb. of coal. Watt was chiefly occupied with his improvements of the steam engine from the year 1762 to 1800. He found that the loss of heat, arising from condensation within the cylinder, amounted to 32 per cent. of that employed, in addition to a considerable loss of time to effect the result.

His first attempt at improvement was to employ a wooden cylinder; but he ultimately arrived at the conclusion that, in order to obtain the greatest economic effect of steam, the cylinder should be of as high a temperature as the vapour entering it—that condensation should be effected in a separate vessel—and the injected water, if possible, cooled to below 100 deg. Fahr.

The means of accomplishing this did not occur to him until 1765, when he conceived the idea that, if a communication were opened between a cylinder containing steam and another vessel exhausted of air, the steam, as an expansive fluid, would immediately rush into the empty vessel, and continue to do so so until an equilibrium was established; and that if the vessel were kept sufficiently cool, by injection of water or otherwise, more steam

would continue to enter, until the whole was condensed.

Thus, the production of a vacuum in the cylinder, without cooling it, was insured, and the principle of the steam-engine became what it continues to be at the present day. In addition to the condenser, Watt employed a method of lubricating the piston by the employment of wax or tallow; placed an air-tight cover on the cylinder, with a stuffing-box round the piston rod, and so admitted the steam above the piston as to act on it in place of atmospheric pressure. The separate condenser was patented by Watt in 1769; and in 1776, he succeeded in obtaining a duty of 21,000,000 from an engine erected at Soho. In the year 1784, he patented the arrangement of levers known as the parallel motion, and applied the governor for regulating the motion of the engine. He likewise, about this period, introduced the system of admitting steam alternately on either side of the piston, thus making the engine double instead of single-acting.

In granting licenses for the use of his inventions, Watt stipulated that he should receive one-third part of the value of the saving of coal effected by his engines as compared with atmospheric machines doing the same work with similar fuel. In order to obtain a standard of comparison for this purpose, a committee was appointed in 1778 to make a trial of two atmospheric engines, at Poldice, in Gwennap, and reported their duty at 7,058,252, which was from that time taken as the standard of Newcomen's engines. The number of strokes made by the several machines was ascertained by means of a train of wheels, called "a counter," attached to the vibrating beam.

The practical application of the expansive property of steam was first suggested by Watt, in 1769; introduced by him, at Soho, in 1776; and, in the following year, at some water-works near London. In 1781, Hornblower took out a patent for working steam expansively, and may be considered to have been the first to bring this subject prominently before the public. He was also the first to employ two cylinders, since known as the combined cylinder engine.

Watt employed what is called low-pressure expansive steam, but, in 1802, Trevithick and Vivian obtained letters-patent, securing the application of high-pressure principles to the steam-engine. In 1806 one of those engines was used at Dolcoath mine for drawing ores, and about this period the idea occurred to Trevithick to employ high-pressure steam in Bolton and Watt's engine, and expanding it down to the density at which it is usually admitted. This method was not, however, adopted till 1812, when it was tried at Wheal Prosper. In this engine the steam was cut off at one-tenth of the stroke, and the pressure in the boiler was 40 lbs. to the square inch. Woolf, in 1810, introduced high-pressure steam in a small cylinder, which was subsequently expanded in a larger one of four times the capacity, and by this means obtained a duty of 34,000,000, which, in May 1816, was increased to 57,000,000. In 1815 Trevithick patented his pole engine, and erected one of them at the Herland mines. Mr. Sims, by combining Trevithick's pole with Bolton and Watt's engine, realised, in 1817, a duty of 49,900,000, from an engine at Wheal Chance. Several machines of this description were erected in different parts of Cornwall about this time, but were ultimately abandoned, and superseded by single-acting engines, in which the steam was worked at a higher pressure, and more expansively than had been hitherto done. Captain Grose, in 1825, erected an engine at Wheal Hope, which, by a judicious system of clothing, yielded a duty of 62,000,000, which, in 1828 he augmented to 87,000,000, in an engine erected at Wheal Towan.

The following table, compiled by Mr. Enys, contains various interesting particulars connected with the engines of Newcomen and Watt:—

Engines.	Newcomen's.	Watt's low-pressure (often expansive).	Watt's high-pressure expansive.
Largest cylinder in inches...	77	63 double	90 single
Load in pounds per square inch	6 to $7\frac{1}{2}$	6 to 9	3 to 18
Period of use	1,720 to 1,778	1,778 to 1,812	1,812 to 1,838
Highest duty in million pounds	3 to 7	12 to 9	20 to 93
Average duty in million pounds		$19\frac{1}{2}$ in 1,793 $17\frac{1}{2}$ in 1,798	about 50
Depth of mines in fathoms	90	200	293

In 1835, Messrs. Lean estimated the number of pumping engines in Cornwall at 104; stamping engines, 14; and winding engines, 66; making a total of 184. These annually consumed 69,559 tons of coal, of the total value of £59,125. The quantity of water delivered from the Cornish mines in 1837, was estimated by Sir Charles Lemon at 37,000,000 tons. The average cost of pumping water in the Cornish mines, from a mean depth of 100 fathoms, is about 1 3-10th penny per 1,000 gallons. This sum includes coal, engine men, and pitmen's wages and sundries, but does not comprehend any charge for wear and redemption of machinery.

Duty of the Steam-Engine.—The term duty was first employed by Watt to express the net result obtained from the combustion of a given quantity of coal. This expression may therefore be regarded as the result obtained by multiplying the weight of water lifted by the space through which it has been raised, and dividing by the weight of coal consumed—$\left(\frac{W \times S}{C}\right) = X$.

Messrs. Boulton and Watt appealed to this test of the efficiency of their engines, when engaged in determining the saving of fuel due to their inventions. Watt also invented the *counter*, for recording the number of strokes made by an engine; this was, as at the present time, attached to the main-beam. At the expiration of Watt's patent, about the year 1800, the duty of the best engine in operation was 20,000,000, which, compared with the best results rendered by Smeaton's engines, viz., 9,450,000, will show an increase of 100 per cent., and this may be taken as the economic value of the several improvements effected by this inventor.

The progressive duty of the steam-engine has been ably traced by Mr. Taylor, from the time of Smeaton down to the year 1828. The researches of this gentleman show that practical experience has done far more than scientific investigation towards attaining the present great economy of fuel; and that this result has been mainly effected by the use of high-pressure steam expansively employed, introducing Trevithick's boiler, and clothing the cylinder and steam-pipes with some non-conducting material.

The periodical increase of duty in Cornish steam-engines from 1813 to 1856 is given in the following table:—

Year.	Approximate No. of engines reported.	Average duty of the whole.	Average duty of the best Engine.
1813	24	19,456,000	26,400,000
1823	45	28,156,162	42,122,000
1833	57	46,142,466	83,306,000
1838	61	48,700,000	84,200,000
1843	36	60,000,000	96,100,000
1848	27	53,166,600	——
1856	24	47,000,000	——

Of late years the duty of the Cornish steam-engine appears to be slightly on the decrease, but this is in some measure due to the employment of fuel of an inferior description. In the year 1838, the Messrs. Lean

reported the average duty of 61 pumping-engines as amounting to 48,700,000 lbs. of water raised one foot high by the consumption of 94 lbs of coal, and, in the year 1856, Mr. Thomas Lean reports 24 engines as having consumed 19,578 tons of coal, which raised 160,000,000 tons of water 10 fathoms high, or 56,000,000 tons lifted 1 foot high by 112 lbs. of fuel, which is equal to 47,000,000 lbs. raised through the same space by the expenditure of 94 lbs. of coal. This shows a decrease during eighteen years of 1,700,000 lbs. per bushel of coal consumed.

Mr. Browne, who, in 1856, reported on 22 pumping engines, gives an average duty of 35,500,000 lbs. of water raised 1 foot high by 112 lbs. of coal, but his system of reporting being dissimilar to that of Mr. Lean, the relation between the two results is not readily apparent.

It has been before observed that no marked improvement in the duty of the Cornish engine has been effected for many years, and it may be remarked that but little increase in the economic performance of this machine can be anticipated until steam of higher pressure and expanded to a corresponding degree be employed. In order to accomplish this object, a longer cylinder might, perhaps, be advisable, whilst such modifications could at the same time be introduced in the valve gearing, and the mode of admitting steam on the piston, as should, in a great measure, avoid impact, and, at the same time, afford the advantages due to high tension.

This idea is, to a certain extent, gaining ground among Cornish engineers, since one of them has proposed to lengthen the cylinder and do away with the parallel motion by running the piston rod in guides. He also suggests fixing the steam valve on the cylinder cover, and the equilibrium in the piston. Whether these propositions are in accordance with increased economy, experiment alone can determine.

Water Pressure Engines.—In localities in which a high fall of water can be procured, the water-pressure engine may frequently be employed with advantage. In this machine the power is obtained by means of a descending column of water acting by its weight on a piston working in a closed cylinder. The credit of inventing this machine appears to belong to Hungary; but various Saxon engineers have also devoted considerable attention to the improvement of this apparatus, and have succeeded in bringing it to a great degree of perfection. The first pressure engine in this country was constructed under the superintendence of Mr. Westgarth, in the year 1765. Smeaton afterwards modified and improved Westgarth's machine in an engine which he constructed in Yorkshire. Trevithick also devoted a considerable amount of attention to these engines, and has since been followed by Dean Armstrong and Darlington. The pressure engine may be either single or double acting. In the former case the piston is moved in one direction by the pressure of a column of water, and returns to its original position by the action of a counterpoise weight, whilst in the latter the piston is alternately acted upon on either side by hydraulic pressure.

The admission and discharge of water from the cylinder is effected by cocks, valves, or pistons, acted on by proper plug gearing, but for large engines piston valves are preferable, as being less liable to derangement. One of the most powerful single-acting hydraulic pumping engines erected in this county, was designed in the year 1842, by Mr. Darlington, for the Alport mines in Derbyshire. The principal dimensions of this machine were as follows:—Diameter of cylinder 50 inches; stroke 10 feet; plunger pole 42 inches in diameter; pressure column 132 feet in height; length of plunger lift 140 feet. The total pressure in this case was 50 tons or 58 lbs. per square inch, and the power employed equal to one hundred and sixty-eight horses.

The cylinder stands on two cast-iron bearers fixed across the shaft; the piston-rod works through the cylinder bottom, and is a continuation of the main rod working the pumps. In front of the main cylinder is a smaller one, with differential diameters, for the admission and emission of water, and right and left are sluice-cocks for regulating the speed of the engine; connected with the feed-cylinder is a third, of still smaller dimensions, provided with regulating cocks.

In starting this engine the sluice-valves and regulating-cocks are opened, and the water from the pressure-column flows into the cylinder, acting upon the piston, until the upstroke is completed. The feed-piston is connected with another of larger diameter, and when relieved from pressure on its upper surface, the water acting between them forces it upwards, by which movement the pressure from the main column is cut off, and the water contained in the cylinder becomes free to escape through apertures prepared for that purpose. With the emission of the water the down-stroke of the engine is effected. The downward motion of the feed-piston is obtained by the auxiliary cylinder and piston, the pressure of water continually acting between them, and by their displacement by the fall-bob and canti-lever on the arbor, the water is either admitted or cut off from the upper piston of the feed-cylinder. The motion of the canti-lever is produced by plugs on the main rod acting on a horn.

Pit Work.—The pumps employed for the drainage of mines were formerly made of wood, but are now almost universally constructed of cast-iron, and vary in diameter in accordance with the work they have to perform. Pumps are, however, seldom less than four inches, and not frequently above 24 inches, in diameter. The pit work of a mine usually consists of a series of pumps, delivering their water into cisterns, placed on bearers thrown across the shaft, in which are placed the windbores or lower extremities of the lifts next in succession. Both drawing and force pumps are employed for this purpose, but the bottom lift is generally a drawing pump, and those placed above it force pumps, or plungers. The drawing lift very closely resembles the ordinary pump employed for domestic purposes. One of the diagrams on the walls represents a plunger pump 42 inches in diameter, erected by Mr. Darlington, at the Alport Mines, in 1841.

Hauling.—In order to remove the produce of a mine to the surface, buckets, called kibbles, made either of wood or sheet iron, are employed. The size of these necessarily varies with the nature of the power to be used for lifting them. Until a shaft has reached a depth of ten fathoms, the only lifting apparatus generally employed consists of a windlass or tackle worked by manual labour. The kibbles and their ropes are, in most instances, arranged in such a way as to pass each other in the shaft, so that whilst one bucket is coming up the other is descending. When the shaft has been sunk beyond this depth, greater power is required, and horses, water, or steam are resorted to in order to obtain the required motive force. When horses are used, the machine employed is called a "whim," and is simply a large windlass, placed vertically, and fixed in the neighbourhood of the shaft. This machine consists of an upright axle, turning in a socket at its lower extremity, and at the upper end working in a bearing supported by a heavy horizontal beam. Around the upper portion of this axletree is constructed a cage or drum, around which is wound the rope to which the kibbles are attached. The arrangement is also provided with a long horizontal arm to which the horses are attached, and in order to convert the horizontal motion of the ropes round the drum into a vertical motion in the shaft, they are passed over pulleys set in a wooden framework called the "poppet-heads" or "shaft-tackle," erected over the mouth of the shaft. Steam is seldom employed for hauling from shafts less than from 40 to 50 fathoms in depth, and an engine is

not often put up until after the value of the mine has been somewhat established.

In Cornwall the low-pressure engine is generally preferred, but in other localities small horizontal high-pressure engines are often employed. The machinery used in Cornwall for this purpose is more expensive than that employed in collieries, whilst the speed of the rope is not only less, but the weight at a draught is, on the whole, not so considerable. The monthly engine reports of Mr. Browne, show that for the year 1854, twelve engines raised 35,833 kibbles from a mean depth of 139 fathoms, and that the average duty of these machines amounted to about 15,500,000 lbs. raised one foot high by the combustion of 112 lbs. of coal. Most of the Cornish winding engines have been designed with a view to the utmost economy of fuel; but it is to be doubted if the engineer always succeeds in this way in effecting a real saving of expenditure, since it must be recollected that an economy of fuel, extending over a very long period, will be required to compensate for the difference of first cost and the resulting interest on outlay.

The difference of expense between hauling by steam and horse-power has been estimated at 50 per cent. in favour of the former; but this is certainly less than the true result, and in deep mines it would be found all but impossible to remove the stuff broken by horses alone. The annexed table affords some interesting particulars relative to drawing engines employed for mining purposes.

Mechanical Preparation of Ores.

Picking.—The ores which are extracted from the mine are not usually sufficiently rich in mineral to enable them to be smelted without being first subjected to sundry mechanical operations. As they are but sparingly diffused through the lode, and are mixed with large quantities of unproductive stone, a preliminary sorting takes place in the mine itself. The miner separates those fragments which do not appear to contain any portion of metallic matter from those which have a certain proportion of ore diffused through their substance; the former being allowed to remain in the mine, where they are employed for filling up certain portions of the excavations, whilst the latter are transported, by means of either barrows or waggons, to the shaft, and subsequently conveyed to the surface. They are now generally washed under a stream of water falling on a coarse grating or perforated iron plate, and divided into at least three classes, 1st, the gangue, or stony matter, which is rejected; 2nd, the rich ore, or best work, which, in the case of copper or lead ores, is frequently sent direct to market; and 3rd, the fragments, which, although containing but a small quantity of mineral, are, nevertheless, too valuable to be thrown away.

Crushing and Stamping.—Before the ores so prepared can be further concentrated, they must be first reduced to the proper degree of fineness, and are, for this purpose, subjected to the action either of a crushing or stamping mill.

The crushing mill consists of two strong iron rollers, set in motion either by steam or water-power, working in a framework of cast-iron, firmly secured by screw-bolts to heavy wooden bearers. The bearings of these rollers are so arranged as to slide in grooves, and consequently admit of the cylinders being either advanced or separated to a greater distance. To prevent accidents to the machine from the passage of large fragments of stone too hard to be broken, a certain degree of elasticity is given to the arrangement by means of levers, which by a sliding bar and shoulder constantly tend to keep the surfaces of the two grinding cylinders in contact, since the other extremity is loaded with an iron box containing heavy weights. The ore to be crushed is allowed to fall gradually between the two rollers through a hopper, the weight on the levers being so adjusted as to suit the degree of hardness of the mineral to be broken. On passing through the rollers, the crushed ores fall into the upper extremity of an inclined cylinder of coarse wire gauze. This being

Name.	Character of Engine.	Diameter of Cylinder.	Length of Stroke.	Number of revolutions per minute.	Speed of Piston in feet per minute.	Pressure of steam on Piston per square inch.	Mean Diameter of Drums.	Speed of rope in Shaft per minute.	Weight of Load drawn.	Tons drawn per day of eight hours.	Depth of Pit or Shafts.	Diameter of drawing Pulley.	Remarks.
		in.	ft. in.		ft.	lbs.	ft.	ft.	cwt.		yards.	ft.	
South Sea Colliery............	Vertical Spur gearing	20½	4 6	60	450	40	10 & 8	945 & 750	20	250	130 & 165	7	
British Iron Works	Horizontal direct link motion.	24	4 6	35 to 50	315 to 450	50	11 & 11	1400	20	400	160	8	
Bryn Malley Colliery............	,, ,,	26	5 0	40 to 50	400 to 500	45	9 & 11½	1130 & 1440	20	400	140 & 210	7	
Minera Lead Mine, No. 1.	,, Spur gear	14½	3 0	50	300	14	5	250	26	100	120 150 170	7	
,, ,, No. 2.	,, ,,	14½	3 0	50	300	15	4½	250	25	100	100	4½	200 Tons if from 2 Pits.
Average of Mines of Cornwall.........	Vertical condensing	22	5 0	15 to 20	150 to 200	12	4½	150	10	...	Variable	5	

set in motion by the same machinery as the rollers them-

selves, divides the pulverised ore into two classes, the one passing through the meshes of the trellis, and falling into a suitable receptacle placed beneath it for that purpose, whilst the other, which is too large to pass through the apertures, is carried to the lower end of the cylinder, where it falls into the buckets of a kind of inverted water-wheel, by which it is again carried to the level of the rollers for the purpose of being re-crushed. The average expense of crushing copper ores by water-power may be taken at $2\frac{1}{2}$d. per ton.

The poorer varieties of ores, and especially those of tin, instead of being crushed by rollers as above described, are pounded into small fragments by means of heavy pestles, set in motion either by water or steam power. The machinery by which this is effected is called a stamping mill, and is provided with a large horizontal axle, furnished with a series of cams arranged in spirals around it. Vertical wooden or iron beams are so attached to large masses of cast-iron, that, when raised by the cams fitted into the axle and corresponding tongues in the lifters, they fall on the mineral beneath them, and thus, by repeated blows, reduce it to a fine powder. The cams are so arranged in the spirals that each lifter shall give three blows during a revolution, and as soon as the first lifter has been released from the cam and begins to fall, the second cam in the series comes in contact with the tongue of the next lifter, and so on until each has in succession struck a blow, when the first lifter is again caught by the first cam belonging to the second system on the axle, when another series of blows is dealt by the several pestles. The lower portion of this arrangement is enclosed in a strong wooden trough or "cofer," in which are openings, into which are fitted gratings made by punching holes into thin pieces of sheet iron. By means of a launder a small stream of water is made to flow continuously into the cofer, and therefore whenever fragments are sufficiently reduced in size to allow them to pass through the gratings, they are carried off by the water into pits in which they are deposited by subsidence. The weight of the pestles usually varies from three to four hundred pounds each, and the number of blows per minute given by each lifter may be from fifty to seventy. The bottom of the cofer is either formed of a large block of cast iron, or of a consolidated mass of hard vein stone, which has become solidified by the constant action of the pestles. The latter arrangement is more commonly employed in this country, but cast-iron beds are much used all over the continent of Europe.

The expense of stamping in this country by steam power, one ton of ordinary stuff, sufficiently fine to admit of the separation of the tin which it contains, may be taken at 1s. 3d., and in some instances tin stuff, containing only about 15 lbs. of merchantable tin in the ton, has been raised and dressed with considerable advantage. Tin ores are usually dressed to a produce of about 70 per cent.; lead ore from 50 to 75 per cent. Copper ores when broken from the vein in Cornwall may be estimated to give an average produce of less than 2 per cent., and are commonly concentrated by mechanical preparation to about $6\frac{3}{4}$ per cent.

Dressing.—The principles on which is based the concentration of metalliferous ores are exceedingly simple, but the arrangements employed for this purpose are very varied, and are modified in accordance with the nature of the minerals to be operated on. If a number of particles, varying in form, size, and density, be held in suspension in a current of water, or allowed to fall through that medium, they will arrange themselves in accordance with the resistance they experience from that liquid. If their form and size be the same, but they vary in density, they will arrange themselves in the order of their respective specific gravities, the lightest forming the upper, and the heaviest the lower strata, of the series. If, on the contrary, their form and density be the same, but the size different, the larger fragments moving more rapidly than the others, will arrive first at the bottom, and form the lowest stratum of the deposit. This arises from the circumstance that although their volumes increase as the product of their three dimensions, the resistance offered by the fluid increases only as the product of two of those dimensions, and therefore the resistance in the case of the larger fragments is proportionately less. If the granules have the same volume and density, but differ in form, those which expose the least amount of surface will fall most rapidly through the water, and form the lowest layer.

It is therefore evident that the particles of ore to be dressed should be reduced, as nearly as possible, to the same dimensions, in order that they may the more freely subside in accordance with the order of their several specific gravities. Each of the fragments operated on must evidently belong to one of the three following classes:—

The first class will consist of the mineral sought, without any admixture of earthy matter. The second will comprehend the fragments which are made up of a mixture of ore and earthy substances; whilst the third will be composed entirely of earthy matter, without any admixture of ore. By a perfectly successful washing, these three classes would be entirely separated from each other, but in practice this degree of perfection can never be wholly obtained, although the results very closely approximate to the theoretical deductions.

The coarser fragments of ore, which have passed through the crusher, are generally concentrated by jigging, whilst the finer, and those that have been reduced by the stamping-mill, are enriched by washing in currents of water, varying in their force according to the nature of the ore and the minuteness of its state of division.

The methods employed for washing the reduced ores differ not only with the nature of the minerals, but also according to the locality in which the mines may be situated, and I shall therefore confine my observations on this subject to a description of some apparatus which we have recently erected, for the washing of lead ores, at a mine producing large quantities of argentiferous galena, associated with carbonate of iron. I would, however, remark that the chief distinction between ancient and modern ore-dressing consists in the circumstances that, whilst in the former the mineral to be treated was subjected, at intermittent periods, to numerous successive operations, it is in the latter so manipulated that the particles are never allowed to deposit themselves, but the operations are continuously carried on until clean ore is obtained on the one hand, whilst the waste is separated on the other.

The ores, on passing through the rolls, fall into a circular sifter which separates the finer particles from the coarser. these being returned by the raff wheel to be again crushed by the rollers. The ore which has been thus sufficiently reduced in size, and has passed through the rotating sieve, is carried by a stream of water into a second rotating apparatus, formed of perforated sheet iron, by means of which the sand and slimes are removed and washed into the buckets of a small water-wheel, whilst the coarser particles escape by the open end of the cylinder, and are removed to the jigging machines to be further cleansed and separated. The finer particles of ore, and the current of water in which they are suspended on falling into the buckets of the wheel, cause it slowly to revolve, and during its revolution time is allowed for the minerals to settle, in accordance with the size and densities of the particles. The result obtained is, that the heavier sands fall to the bottom of the buckets, whilst the lighter slimes are poured out of the wheel and carried off through suitable launders to the slime pit. The sands remaining in the bottom of the buckets are washed out by means of jets of water obtained by a pressure of about 15 feet in height, admitted behind the centre, and are thus carried off to round buddles, where their concentration is further effected. The tails of these buddles are thrown away, as being of no value; the middles are rebuddled in the same machine; and the heads, after being subjected to washing in a hand buddle, are passed to the dolly-tub, and from thence carried

to the smelting house. The slime pit is in the form of an inverted cone, the slimes being admitted at one of its sides by means of a divided head-board, whilst an aperture in the opposite direction admits of the escape of the water and refuse matters held in suspension. As the water passes very slowly through this arrangement, all the more valuable portions of the slime are deposited at the bottom, and are continuously let off by means of a plug valve, over the surface, either of Brunton's cloths or of sleeping tables. The conical slime pit and slime separator were first introduced by Captain Isaac Richards, of the Devon Consols Mines.

The round buddle consists of a conical floor, from 18 to 20 feet in diameter, over which the sands are distributed by means of a launder emptying itself through a revolving funnel supported by a central cone of hard wood or cast-iron. This apparatus is furnished with arms carrying long brushes, which are constantly drawn over the surface of the deposit, and assist in carrying the lighter particles to the outer edge of the circle.

Conclusion.

Although the metalliferous productions of this country annually amount to at least £35,000,000, and the prosperity of Great Britain is in no small degree dependent on her mineral resources, it must be admitted that, even when most judiciously and skillfully conducted, mining operations are more or less hazardous and uncertain in their results. When taken in the aggregate, however, there can be no doubt but that this industry is highly remunerative. It is a common saying, that "all is dark before the pick's point;" and hence, since the miner is unable to see what lies before him, he is not unfrequently, however cautiously and judiciously he may have proceeded, disappointed in his anticipations of profit, and finds, after incurring a large expenditure of both time and money, that his judgment has been at fault, and that his expenditure has been unremunerative. If, however, we take the average return made by well-selected and judiciously-managed undertakings, we shall find that it amounts to from 12 to 14 per cent. on the market value of the property, and if to this be added the increased value of the mines themselves, this amount will be very materially increased.

The mining engineer should not only be well acquainted with the principal facts of geology, mineralogy, and chemistry, but, above all, should possess extensive experience in his profession, and be acquainted with all the details of mining operations, and consequently should have received a sound scientific education, and have had long and practical experience. The management of the mines of this country has usually been confided to individuals who, by their industry and intelligence, have raised themselves from the ranks of the working miner to the position of mining captain, and who, therefore, possess a far larger amount of practical knowledge than of theoretical acquaintance with their business. Although it cannot be denied that experience is far preferable to theoretical knowledge, it will nevertheless be admitted that the two combined will be found more advantageous than either taken separately, and that a sound education is, in all cases, a good foundation on which the superstructure of experience may be subsequently erected.

When but one alone of these qualifications is attainable, there can be no doubt but that the practical man is to be infinitely preferred to the theoretical, but as a knowledge of facts deduced from the observations of others materially facilitates the acquisition of fresh knowledge from our own experience, it is to be hoped that the mining community of this country will not fail to avail itself of the advantages to be derived from the school in Jermyn-street, and that, on the other hand, the students on leaving that establishment will not consider that theory alone, or any mere course of elementary study can make them miners.

As I have before remarked, mining, when most judiciously conducted, is, to some extent, a speculative occupation, but when, on the contrary, the management of mining undertakings is confided to inexperienced and incompetent persons, the result becomes a certainty, and total failure is the consequence.

DISCUSSION.

Mr. C. H. Smith wished to ask Mr. Phillips whether, in his opinion, in the operation of blasting rocks, benefit would not be derived from having the cavity at the bottom of the bore-hole of larger dimensions than the cylindrical hole itself, inasmuch as he apprehended in a hole of equal dimensions throughout, there was a tendency to the blowing out of the gunpowder (much in the same way as in a gun barrel), instead of its having the rending effect desirable in the operation of blasting rock for mining purposes.

Mr. Phillips did not conceive that any practical benefit would result from having the cavity at the extremity of the bore-hole bell-shaped, to effect which several inventions had been introduced. Under the present system the blasting was carried on by the miner with rapidity and efficiency. No doubt, however, the proposed modification would be useful if it could be effected with the same economy as the ordinary method, and with no greater danger of the tool being broken in the cavity. His impression was, that unless something was introduced better than had been hitherto invented, it was practically useless to make any attempt of the kind described by Mr. Smith. The greatest improvement that had been introduced in rock blasting was the substitution of cast-steel for the ordinary iron borers tipped with steel, and much less wear of the tools was caused.

Mr. Smith entered into some details of experiments in rock blasting, undertaken at the suggestion of a committee of this Society some years since. A block of stone being provided, a hole of one and a half-inch diameter, was cut straight into the heart of the stone, and at the bottom a cavity of from three to four inches in diameter was worked out in a very short time, which formed a chamber for the powder; and under such a plan he apprehended that the shock of the discharge would be more effective than in the case of a mere cylindrical hole, which offered less resistance. Mr. Smith added, that the material on which the experiment was tried was Portland stone.

Mr. Varley said he had witnessed the experiments referred to by the last speaker, and he considered the results highly satisfactory. He described the means by which the cavity was formed at the bottom of the bore-hole. A cast-iron ball was introduced, which served to divert the tool from the cylindrical course, and by working round the ball the cavity was formed with considerable facility. This, of course, had reference to borings in a downward direction, but he thought the same operation might be effected in upward borings, by placing the iron ball upon a rod, or supporting it at the top of the bore by means of a spring.

Mr. Pearsall inquired whether gun-cotton had been used to any extent for blasting purposes.

Mr. Phillips replied that, as far as British mining was concerned, he could not speak as to any attempts to use it. It was objectionable on account of its liability to explode from concussion, and to be injured by damp. Experiments with gun-cotton had been made in the mines in Saxony, but it was abandoned in favour of gunpowder, which the miners found to be safer and more efficacious.

Professor Tennant could hardly agree with Mr. Phillips as to the average profit returned from investments in mines, and he considered that from 12 to 14 per cent. was placing it at too high a figure. With regard to the elementary education of the miner in the matters incident to his pursuits, he looked upon that as a question of national importance. Attempts had been made to establish schools for instruction in the mining districts of England, but, up to the present time, those attempts had not been

successful. The late Sir Charles Lemon had offered the munificent sum of £10,000 towards the establishment of mining schools in the heart of the mining districts, but it was not responded to by the persons in those districts most interested in the matter. Other attempts to establish schools had been made, but he feared they were languishing for want of proper support. If the mine owners of the country were properly alive to their own interests, they would certainly forward these schools in every way in their power; for, it was well known that, in every description of industrial pursuit, the intelligent workman was always the best workman. He contended that persons destined for mining pursuits ought to receive elementary instruction in chemistry, mineralogy, and geology, which would make them more fitted for their occupation than if they simply relied upon the practical knowledge they might gain by experience. He was astonished to find the difference in point of education between the miners of England and those in many parts of the Continent. He had made inquiries of working miners on the Continent as to the nature of the material they were at work upon, and those inquiries had been answered in a way that he had failed to meet with even from mining captains in England. In point, however, of perseverance and industry, he would place the English miner as high as any of his class in the world. With reference to mining speculation, he was frequently in the habit of meeting persons who asked his advice as to how they were to act in matters of this kind, they having been induced to invest their money, solely from hearing of the enormous profits made in other quarters, and having met with bitter disappointment.

Mr. Ninnis said, with reference to blasting, that he did not see any practical advantage to be derived from an enlarged aperture at the end of the bore, inasmuch as under the plan generally in use, the cavity was sufficiently large to admit of the necessary quantity of powder being placed in it. Such a plan as that suggested, he thought, would be more applicable to open quarries than to underground operations. The author of the paper had pointed out, in a very lucid manner, the advantages of properly-arranged machinery in the economical working of mines, as well as the improvements which had been introduced during the last 50 or 60 years. Within his own recollection the crushing mill was first introduced into the west of England, and consisted of rollers of 12 inches diameter worked by a water-wheel with a small sieve placed underneath them to receive the crushed material. The ore on passing through the sieve was taken away in barrows, and washed after the most simple fashion. Previous to that the ore was broken up by women, the operation being called "bucking," but the introduction of the roller-crushing machine was considered a great improvement. In the machine, the drawing of which was exhibited, the contrivances were very admirable, and the object of economy in working appeared to be fully attained. The round buddle exhibited was also a great improvement upon the old plan of "buddling," and was likely to be very useful. With regard to the value of mining property generally, he did not go to the extent of Professor Tennant in considering it an undesirable investment. His own experience through life had been that mining adventures, entered into with judgment and carried on with honesty, were a satisfactory mode of employing capital. He contended that mining operations ought to be carried on upon the system of underwriting. If capitalists were guided solely by the prices quoted in the market, and by the representations of interested parties, the probability was that they would, in the end, find themselves considerable losers by their speculation. At the same time, he thought it was not proper to charge upon legitimate mining adventures the result which had followed a reckless system of gambling in such matters.

Mr. Thomas Scott considered it essential that education in the elementary sciences connected with mining should be imparted to those who were engaged in that pursuit, in which respect he believed they were very deficient at the present time. In his intercourse with mining captains in England and in Ireland, but more especially in the latter, he found that such professional education as they had acquired had been for the most part matter of chance. Allusion had been made to the unsuccessful attempts to establish schools of mining in the mining districts. The result was, that they had an illiterate class of workmen, and an educated miner was the exception to the general rule. With regard to the profitable nature or otherwise of investments in mining, it was to be remarked that in too many cases adventures were got up for speculative purposes. A company was formed and shares were issued; the promoters always taking care to reserve a large slice to themselves. Calls were made, a captain was engaged, and operations were commenced. It was pretty well known that engineers were not wanting who could furnish glowing reports of the supposed capabilities of a mine. Call after call having been made upon the shares, it would become necessary that there should be some show for the money, and in such case it might be, that, yielding to the pressure from without, the captain would "pick out the eye of the mine," as it was called; or, in other words, not work the lode in a legitimate manner, but only for the purpose of sending some amount of ore into the market. That being done, an outcry was got up as to the yield of the mine, and, thereupon, fresh shares would be issued, and further calls made upon the hapless shareholders, and in that way enormous sums of money had been lost. He submitted that, whilst it was desirable to have the workmen better educated, they also wanted honesty on the part of those who managed these undertakings.

Mr. Phillips fully subscribed to the view expressed, that to improve the education of miners in England would be to improve their position in life. In reply to what had fallen from Professor Tennant, with regard to the superior education of the miners on the Continent, he (Mr. Phillips) would put in a plea for the English miner. He had had the management of one of the largest mines in Westphalia, in which between 300 and 400 German miners were employed; but when a shaft had to be sunk in hard ground, the German workmen were unable to do it, and the work was contracted for by English miners at a less price than it could be done for by native workmen, although the German miners earned only 50s. per month, and the English miners £8 per month. It was true that the Germans were better educated as to reading and writing than the English miners, but they had very little knowledge of mining, which arose from this fact, that at one time the Germans would be occupied in farming, at another time in smelting, and when they had any money they would do nothing at all. The English miner was for the most part attached to his calling, and owing to the tribute system, which had obtained almost from time immemorial, it was to his interest to acquire such a knowledge of his business as to know where to get a "pitch" to earn a good living for himself; and when once a family engaged in mining, they remained miners for many generations.

Mr. Ninnis would mention, in illustration of the benefits resulting from a practical education, that he had known cases in which persons had taken a "pitch" at a higher price than was offered by others, simply from their knowledge of the quality of the material they were going to work upon. It could not be said that all the Cornish miners were ignorant men.

Mr. Hyde Clarke differed from Mr. Tennant, as to the relative intelligence of the English and German miners. The facts and statistics in the paper proved the great progress of English mining in this century, which was owing to improvements effected by the intelligence of the mining class. Under these circumstances it could not be conceded that the position of the English miner was so bad as had been assumed. With regard to

mining education, neither was it to be assumed that the attempts were failures, or that they ought to be abandoned, still less that their want of progress was the fault of the mining interests, when it might be the fault of the system adopted. It had been urged that Sir Charles Lemon's scheme failed, and the mining schools languished, because the mining interests did not contribute the sums required for their support. Now, whom did they call upon to contribute? First, the lord or landlord, few of whom received large incomes, and many very small dues; next, the mining shareholder, who had only a leasehold interest in what had been defined as an uncertain speculation; and thirdly, the working captain and miner, with very small earnings. Under the circumstances, these were the last persons who could be expected to contribute; but, as mining undertakings, however uncertain to those engaged in them, undoubtedly added largely to the resources of the country, so it was for the interest of the community to support the whole expense of mining education, and to give free instruction to the working miner. However small the fees were, they were a heavy tax on the working captain or miner, who had to make what was a great sacrifice to him, the sacrifice of his working time for the purposes of study, and though he would undoubtedly reap a good return from his improved knowledge, the community would no less benefit. So far from the miner being called upon to contribute or make a sacrifice, he should be encouraged, in every way, by studentships and scholarships, freely given, to attend the schools, more particularly in the beginning, when he was not prepared by experience to appreciate what he considered as merely theoretical knowledge.

Professor Tennant wished to add that an attempt was made, in 1804, to establish a school of mining, and a large sum was subscribed under the auspices of Sir John St. Aubyn, in order to establish a School of Mines at the Royal Institution in Albermarle-street. A sufficient sum was not forthcoming, and the subscriptions were returned. He believed a sum of upwards of £4,000 was subscribed. He hoped to see that system carried out upon an extended scale, which would result in the miners being better educated, and, therefore, superior workmen.

The Chairman said it now became his duty to propose a vote of thanks to Mr. Phillips for his able and interesting paper, and in so doing he desired to be permitted to offer a few remarks. The paper with which they had been favoured comprised a very comprehensive *résumé* of the history of mining, and an able description of many of the processes employed in that branch of national industry. It showed what must be considered a very advanced state of mining in this country, as compared with what it was half a century ago. With reference to the remarks of Mr. C. H. Smith, upon the subject of boring holes for blasting purposes, and the idea he had suggested of an enlarged cavity at the end of the bore, he (the Chairman) did not think that, for mining purposes in general, any practical advantages would be gained from carrying out that plan. In the operation of blasting, as at present carried on, the results were almost universally such as the miner desired to effect; the methods used were generally suited to the circumstances of the mine; the operation was conducted with great rapidity, and had the effect, in most cases, of detaching the quantity of rock that was required to be displaced. Knowing as he did the great ingenuity and talent of Mr. C. H. Smith in all matters connected with the cutting of even the hardest rocks, and his extensive knowledge of the quarries throughout the kingdom, there was no one to whose suggestions on such matters he would bestow greater attention. Mr. Phillips had referred to the extreme fluctuation which took place in mining, and this had given rise to observations which really only ended in this—that mining, like all other things, might be conducted with ability or with want of ability; with honesty or with want of honesty; but as the operations were underground, he must say that it gave rise to a great deal of what he might call unwise speculation, resulting, in many cases, in a vast amount of disappointment to the parties who had entered into it. One of the first things to be done, before they could have mining in this country brought to perfection, was to make all those who entered into mining operations tolerably well acquainted with what they were going into. It was all very well to say, that if people only entered into judicious speculations, they would succeed. The difficulty was to ascertain what was a judicious speculation. He had known persons who had invested large sums of money in mining adventures without the least idea of the nature of the mines, the position of veins, the character of the works, or any other conditions of the undertaking. They took shares merely because they heard that other persons had made a great deal of money by such speculations; and, in his own experience, he could confirm the statement of Professor Tennant, as to the many expressions of bitter disappointment that came from persons who had fallen victims to unsuccessful mining adventures, and who, in the recital of their melancholy history, proved that they had been most sadly and egregiously taken in. He was glad to find that Mr. Phillips, in his paper, had referred to, and taken some extracts from, the curious old literature and charters which were in existence in relation to mining. These would be found highly interesting to those occupied in mining pursuits, inasmuch as there was a quaintness and force about the writings of those ancient authors which were useful and suggestive and withal picturesque. Another point of interest in the paper was the subject of the returns made to the Mining Record Office, in Jermyn-street. Those returns were regularly published, and from that source Mr. Phillips had gathered some of the valuable statistics given in the paper. He (the Chairman) felt the more interest in the success of that establishment inasmuch as twenty years ago it was at his office, in Newcastle-upon-Tyne, that a committee first met for the purpose of urging upon the Government the great importance of such records of mining being kept. The result of the memorial then drawn up by that committee was that a small fund was devoted to the desired purpose; this had since been increased, until, at the present time, the Mining Record Office, under the able management of Mr. Robert Hunt, had been brought to a state of great proficiency and usefulness. He thought nothing of that description could be more valuable than the statistics which Mr. Hunt had collected, and which were published every year. He believed in the present year those records would embrace the particulars of stone quarries, as well as those of coal and other mineral products, so that a more accurate view of British mining would now be afforded than the public had ever before had an opportunity of obtaining. Mr. Phillips had also referred to the extreme fluctuation of prices. That was a subject very intimately connected with the progress of mining, and one which was apparently out of the reach of all calculation. So long as uncertainty of price hung over mineral produce, it was impossible that miners could make their calculations with that degree of certainty which was desirable as a basis for long prospective operations. The advantage of machinery, as compared with the system of levels, had been well pointed out by Mr. Phillips, and he fully agreed with him in thinking that wherever mining operations on a large scale were undertaken, a proper arrangement of the shafts and engines was to be preferred to what was formerly thought to be the more economical method of driving what miners called "day levels." Reference had been made to the School of Mines, in connection with the Museum of Practical Geology in Jermyn-street. That Museum was almost entirely got up through the persevering energy of the late Sir Henry de la Beche, and was at the present time most ably and liberally conducted by Sir Roderick Murchison. By means of an active and most efficient staff of officers, instruction was given in the various branches of science connected with mining opera-

tions. Lectures were also frequently given to large numbers of such of the working classes as chose to avail themselves of so valuable an opportunity. Mr. Phillips had mentioned a great name connected with engineering and mining—that of Smeaton—some of whose works, in connection with mining in the north of England, were of great extent and importance, and had led to many valuable improvements. The impress of his mind had been given to the character of mining works, and this had an important practical bearing upon the further improvement of such operations. In connection with the water-engine made by Mr. Westgarth, he might mention that he had in his possession a letter written by Smeaton, in which he strongly recommended Mr. Westgarth to the attention of the Society of Arts as a most ingenious and deserving man, showing the estimation in which this Society was held by so eminent a man as Smeaton. The subject of mining altogether was one of much greater importance than it was generally considered to be; for, if they looked at the position they would be in in the absence of coal, they would see that the due consideration and prudent use of it, and indeed of all minerals, as well as the safe and economical working of them, were subjects of the greatest importance. With respect to the quantity of coal yet remaining in this country great variety of opinion had prevailed. He, himself, was not so sanguine as some as to the long duration of the means of profitably working coal in this country, but whatever would tend to the economical development of the mineral resources of those industries which were at the very foundation of all our manufacturing greatness, was of the highest importance in a national point of view. He was sure the meeting would heartily concur in a vote of thanks to Mr. Phillips, for the interesting and instructive communication which he had laid before them.

A vote of thanks was passed to Mr. Phillips.

The Secretary announced that on Wednesday evening next, May 5th, a Paper by Mr. Charles Sanderson, on "Iron: its Commerce, and Application to Staple Manufactures," would be read.

SOUTH KENSINGTON MUSEUM.

During the week ending 24th April, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 5,221; on Monday and Tuesday (free evenings), 4,842. On the three Students' days (admission to the public 6d.), 1,392; one Students' evening, Wednesday, 188. Total, 11,643.

Home Correspondence.

THE SMOKE NUISANCE.

Sir,—Smokeless combustion has been long enough an interesting and important subject, both under a sanitary and commercial view, to render no apology necessary for a few lines, in which I would venture to lay before the large body of coal burners by whom your papers are read, a very successful method of reducing the production of smoke to a minimum in coal fire.

The advantage of obtaining this result in the manner described, is enhanced by the fact that it is attended with the greatest economy, the fuel burnt being of the cheapest kind, and one which has become of late rather heavy on the market, on account of the increased consumption of coke and Welsh coal.

The method is simplicity itself, and is as follows:—Assuming the furnace to be of the ordinary construction adapted for steam purposes, and that the fire is already well lighted, level, and clean, and the bars well covered, take, of north country slack (value about nine shillings per ton, delivered), one and a-half hundred weight, wet it with one bucket full of water, and following up the shovels full in rapid succession, put the whole on one part of the fire; the place is immaterial—front, sides, middle, or back—but cover less than half of it, and take care especially of one point, on which the whole depends, viz., that the heap has a black top, and that it is thick enough for no gases to burst through it.

Before the fresh coal has been on this fire many minutes, a rapid discharge of gases will take place from the under side of the fresh coal, which, passing out through the live coal, will burn with an intense flame all round the edges of the heap. The fresh coal will thus part with all the smoke-producing gases, and become thoroughly caked; until this is the case do not touch it, nor even then unless there is a necessity.

Should other parts of the fire burn into holes while this is going on, feed with coke, but no harm will arise should the heap burn ever so hollow.

When the coal is consumed repeat the process, which may be carried on conveniently on both sides of the furnace simultaneously or alternately.

The idea of coking the coal on its own fire is no novelty, but the essential necessity of keeping a black top has never been insisted on, and, consequently, the plan of firing on part only of the fires may fail or succeed according as that point has been attended to.

I have tried this system for some time, with a consumption of ten tons per diem, and have burnt many hundred tons of slack; the quantity of coke used, on account of my chimney being one of the most noticeable in London, having been about one-third of the whole consumption.

I have little doubt that, in many places, with the exception of the time when fresh fires are lighted, the furnaces might be entirely fed with small coal, which is, for this purpose, far preferable to that of rough size.

Small coal as purchaseable at the London wharves has an efficiency, when thus burnt, only three or four per cent. by weight below the best gas coke, value 18s. per ton.

The method described is the perfect opposite of the time-honoured practice of thin and level firing; and, in Cornish boilers, my own practice of firing, with slack on both sides, brings the section of the fire to the form of a crescent.

To impress the essential point, I have called this system "black-top firing."

I am, &c.,
CHARLES GREAR.

London, April 24, 1858.

Proceedings of Institutions.

Royston.—At the Institute, on Monday and Tuesday, 12th and 13th inst., Dr. J. C. Daniel delivered the first two of his course of four lectures on the "Four Stuarts." The subjects were—James the First and Charles the First, their private lives and characters.

Salford.—The fourth annual report of the Mechanics' Institution states that the success of the Institution, in its educational departments, was never more marked, and that the numbers attending the classes are considerably above those in the preceding year. A greater proportion than heretofore of the members has been of the adult class. The directors tender their thanks to Messrs. Mather and Platt, Oddy Thompson and Co., and Mr. Guest, for the support they have rendered the Institution, by purchasing and presenting tickets of membership to their workmen, and they earnestly recommend other firms to follow so desirable an example. The directors also thank several other gentlemen for liberal donations to the funds of the Institution. Day schools for boys and girls are connected

with the Institution, and the welfare of these schools has continued to engage a large share of the attention of the directors, who have devoted the Lecture-room of the Institution for the boys' day-school, and have converted the Reading-room and a room adjoining into the girls' day-school, thereby effecting a very desirable improvement in the school-accommodation of the Institution. The evening classes have been well attended, and are conducted in an efficient manner. The subjects taught are:—Reading and writing; arithmetic and grammar; book-keeping; mathematics; algebra; mechanical and architectural drawing; French, and German. There has been a marked increase in the numbers attending the majority of these classes for the quarter ending Christmas 1857. The classes for book-keeping and algebra have been opened during the year. The first public examination of the members attending the classes of the various Institutions in connection with the Institutional Association of Lancashire and Cheshire took place in September last, at the Manchester Athenæum, but, in consequence of the limited notice given by the Council of the Association prior to the examination, only four of the members of this Institution were able to become candidates. Three out of the four competitors, however, obtained certificates and prizes. Several donations have been made to the library, and the books have had an average circulation—the class of works most in demand being those of a standard character. The whole number circulated during the year is 2,200.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
Entomological, 8.
Architects, 8. Anniversary.
United Service Inst., 8½. Mr. J. Bourne, "On the Internal Communications of India."

Tues.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Civil Engineers, 8. I. Discussion on Mr. Hood's Paper "On Railway Stations." II. General Tremenheere, "On the Public Works of the Bengal Presidency."
Pathological, 8.
Photographic, 8.

Wed. ......United Service Inst., 3. Colonel Wifford, "On the Coast Defences of England."
Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. Chas. Sanderson, "On Iron; its Commerce and Application to Staple Manufactures."

Thurs. ...Zoological, 3.
Royal Society Club, 6.
Antiquaries, 8.
Chemical, 8. Dr. Odling, "On Atoms and Equivalents." Adjourned Discussion.
Linnæan, 8. I. Mr. Masters, "On a new species of *Bellevalia* from Mount Ida." II. Mr. Mitten, "On Indian Musci." III. Dr. Mueller, "Contributiones ad Acaciarum Australiæ cognitionem."
Philological, 8.
Royal, 8½.

Fri. ....United Service Inst., 3. Major Griffiths, "On Field Fortification."
Archæological Inst., 4
Royal Inst., 8½. Mr. J. P. Lacaita, "On the late Earthquakes in Southern Italy."

Sat..........Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 15th April, 1858.

173. Army Estimates—Proposed Alterations.
187. Bullion—Return.
43. Bill—Chelsea Hospital and Waterworks Exchange of Land.
East India (Despatch of Troops)—Further Papers.
Australia (Exploring Expedition)—Papers.

Delivered on 16th April, 1858.

177. Army—Return.
185. Spirits—Returns.
188. Trinity College (Dublin)—Return.
194. Sardinian Medals—Paper.
45. Bill—Hainault Forest (Allotment of Commons).
Cape of Good Hope (Kaffir Tribes)—Further Papers.

Delivered 17th and 19th April, 1858.

190. East India (Education in Behar)—Copy of a Letter.
176. Corn—Return.
178. Army (Regimental Establishments)—Return.
181. East India (North West Provinces)—Return.
184. Ship "Ganges," &c.—Return.
193. National Debt—Account.
197. Manhood Suffrage, &c. (Victoria)—Copy of an Act.
200. Committee of Selection—6th Report.
113. Harbour, &c., Bills (16. Mersey Docks and Harbour (New Works, &c.)—Board of Trade Report.
118. Local Acts (24. Trent Navigation; 25. Andover Canal Railway; 26. Tramore Embankment; 27. Clyde Navigation; 28. Victoria Station and Pimlico Railway; 29. Whitehaven Junction Railway; 30. Middlesborough Improvement; 31. Tees Conservancy)—Admiralty Reports.
44. Bill—Juries (Ireland).
46. ———Chancery Amendment.
47. ———Chelsea Hospital (Purchase of Lands).
48. ———Portumna Bridge (Ireland)—(As amended by the Select Committee).
East Indies (Mutinies)—Supplement to Papers (No. 6).

Session (Second), 1857.

310. Sessional Printed Papers—Numerical List and Index.
310 (1). Sessional Printed Papers—Titles and Contents.

Delivered on 20th April, 1858.

164. Game Laws—Abstract of Return.
201 (1). East India (Revenues, &c.)—Return relating to Writerships.
201 (2). East India (Revenues, &c.)—Return relating to Proprietors of East India Stock.
203. Army (Civil Administration)—Return.
Passports—Correspondence.
Customs—2nd Report of Commissioners.

Delivered on 21st April, 1858.

198. Dunfanaghy Union—Correspondence, &c.
199. Coals (Aldershot)—Return.
204. Reformatory Schools—Return.
209. Enlistment of Krewmen—Return.
213. Police Certificates—Return.
113. Harbour, &c., Bills (27. Middlesborough Improvement)—Board of Trade Report.
33. Bill—Cruelty to Animals Act Amendment.

Delivered on 22nd April, 1858.

206. Revised Army Estimates.
207. Army (Officers allowed half-pay with Civil Situations)—Return.
214. Barracks—Return.
216. Railway and Canal Bills—2nd Report from General Committee.

Delivered on 23rd April, 1858.

195. Sandhurst Royal Military Academy—Return.
202. Prince Edward Island—Papers.
210. Army (Sums paid to Relatives of Deceased Officers)—Statement.
113. Harbour, &c., Bills (28. Wallasey Improvement)—Board of Trade Report.
49. Bills—Poor Law Amendment.
51. ——— Registration of County Voters (Scotland).
53. ——— Customs Duties (No. 2).
The "Cagliari" (Fac-simile of the Draft of Sir J. Hudson's Letter)—Further Paper.
The "Cagliari" (Opinions of the Law Officers of the Crown)—Further Correspondence.
East Indies (Mutinies)—Further Papers (No. 7).

Delivered on 24th and 25th April, 1858.

64. Order of the Bath—Returns.
68 (3). Trade and Navigation—Accounts (31st March, 1858).
201 (3). East India (Revenues, &c.)—Accounts of Imports and Exports.
201 (4). East India (Revenues, &c.)—Statement of Tariff on Duties.
201 (5). East India (Revenues, &c.)—Statement of Territories, &c.
201 (6). East India (Revenues, &c.)—Statement of the Number of Natives employed in the Civil Administration.
201 (7). East India—Statement of Lines of Railway, &c.
117. Railway and Canal Bills (96. Limerick and Foynes Railway)—Board of Trade Report.
211. Foot Guards—Return.
215. Bands—Return.
218. Education—Returns.
220. Patriotic Fund—Correspondence.
40. Bills—Roads, &c. (Scotland).
52. ——— Excise Duties.
56. ——— Property Qualification.
50. ——— Reformatory Schools (Ireland).
57. ——— Registration of Partnerships.
60. ——— Franchise Prisons.
61. ——— Durham County Palatine Jurisdiction.

Delivered on 27th April, 1858.

179. East India (Public Debt)—Return.
222. General Board of Health (Orders in Council)—Returns.
223. Board of Health (Expense of Printing, &c.)—Returns.
227. Seamen's Savings Bank—Account.
201. East India (Revenues, &c.)—Returns relating to the Armies of India, &c.
132. Railway Acts—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 23, 1858.]

Dated 16*th February*, 1858.

298. J. Coutts, Willington-lodge, Willington, Newcastle-on-Tyne—An improved paint, pigment, or composition, more particularly adapted for coating the hulls of ships, either iron or wooden, so as to prevent damp, corrosion, or fouling, and apparatus for drying and warming surfaces, and preparing and applying to the same such paint, pigment, or composition.

Dated 24*th March*, 1858.

617. C. Kottula, Liverpool—Imp. in purifying soda leys, whereby they are rendered capable of saponifying all fatty matters or resins used in the manufacture of soap.
618. C. Kottula, Liverpool—Imp. in the manufacture of compact neutral soap.

Dated 3*rd April*, 1858.

704. A. Pelez, 9A, Mortimer-street, Cavendish-square—A new apparatus for deepening rivers and rendering them navigable. (A com.)
714. E. Edwards, Birmingham—An imp. or imps. in the manufacture of glass finger plates for doors and other articles of like manufacture.

Dated 5*th April*, 1858.

720. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—Imp. in grain and grass harvesting machines, and in the automatic delivery thereof of cut grain. (A com.)
722. J. Smith, Oldham—Imp. in the manufacture of pile fabrics.
724. S. Fox, Stockbridge Works, Deepcar, and J. Chesterman, Sheffield—Imp. in stays or corsets, and in the manufacture of steel employed therein, and applicable to other articles of dress.

Dated 6*th April*, 1858.

726. L. T. Van Elven, Clapham-road—Imp. in apparatuses for raising and lowering weights and bodies.
728. H. Wetherell and G. Gray, Upper Chapman-street—An apparatus for preventing down draughts and currents in chimneys, flues, and shafts.
730. J. Camp, John street, Tysoe-street, Clerkenwell—An improved construction of expanding portfolio.
732. C. H. Chadburn, Liverpool—Imp. in pressure guages.
734. J. Erckmann, Rue Fauboug St. Honoré, Paris—Imp. in galvanic batteries.
736. B. Blanché, Bordeaux, France—Using Malacca and Manilla cane instead of whalebone.
738. J. Rose, Glasgow—Apparatus for applying heat, cold, moisture, fumes, vapours, and other agents in medicine and surgery. (A com.)

Dated 7*th April*, 1858.

741. A. Casartelli and L. Casartelli, Liverpool—Imp. in pressure and vacuum gauges.
743. W. A. Gilbee, 4, South-street, Finsbury—An improved machine for corking bottles. (A com.)
744. J. Wright, 10, Alfred-place, Newington-causeway, Southwark—Imp. in the mode of treating leather in order to render it waterproof. (A com.)
745. W. Armitage, Farnly Iron Works, and H. Lea, Farnly, near Leeds—Certain imp. in the manufacture of iron.
746. R. Worthy, Albert-street, Regent's-park—An apparatus for preparing medical fomentations.
747. G. W. Baker, Park Farm, Woburn—Improved signal apparatus to be applied to railways.
748. W. Nimmo, Manchester—Imp. in the manufacture of printed woven fabrics.
750. John Doherty, Edinburgh—Imp. in buttons or dress fastenings.
751. C. F. Whitworth, Sheffield—Imp. in signal apparatus for railways.

Dated 8*th April*, 1858.

754. J. Cartwright, Shrewsbury—Improved apparatus for transmitting motive power for driving machinery.
755. G. Davies, 1, Serle-street, Lincoln's inn—Imp. in the manufacture of wads for ordnance. (A com.)
756. G. E. Taylor, Oatlands, Leeds—Imp. in machinery for raising the pile of cloths.
757. G. Rowland, Brussels—Imp. in the manufacture of artificial whalebone.
758. F. W. Mowbray, Bradford, and J. Broadley, Saltaire—Imp. in means or apparatus employed in weaving.
759. W. Clark, 63, Chancery-lane—A burner for candles. (A com.)
760. T. Greenwood, J. Batley, and J. Dockray, Leeds—Imp. in machinery for carding, opening, straightening, and preparing to be spun, tow and other fibrous materials.
761. T. Roberts and J. Dale, Manchester—Imp. in the production of a substitute for oil used with pigments, and in the preparation of pigments suitable thereto.

Dated 9*th April*, 1858.

763. W. Ager, Rohrsburg, U.S.—An imp. in rice cleaning machinery.
765. W. R. Jackson, Baltimore, U.S.—A self-acting railway break.
767. H. Bayley and J. Greaves, Staleybridge—Imp. applicable to certain machines for spinning and doubling fibrous substances.
769. Hon. W. Talbot, Army and Navy Club, Pall-mall—Imp. in means or apparatus to facilitate the lowering and detaching of boats from ships or vessels, which improvements are also applicable to lowering and disengaging other bodies.

Dated 10*th April*, 1858.

771. R. M. Ordish, 18, Great George-street, Westminster—Imp. in suspension bridges and suspended girder bridges.
773. G. Guyot, Denain, France—Welding broken cast-iron pieces.
775. P. Brun, 1, Rue de Grenelle, St. Honoré, Paris—The application of an improved blowing fan to steady or portable forges, with or without reverberatory furnaces, as well as to ventilation in general. (A com.)
777. S. T. Parmelee, Edinburgh—The manufacture of improved belting for machinery or other purposes.
779. W. G. Armstrong, Newcastle-upon-Tyne—Imp. in the means of firing or igniting explosive projectiles.
781. D. McCrae, Greenock—Imp. in preserving ships' bottoms and other exposed surfaces from fouling and injury or decay.
783. A. Manbré, 10, Rathbone-place, Oxford-street—The manufacture of a colouring matter for colouring spirits, beverages, and other liquids from the sugar of potatoes, known as glucose and syrup "de fecule."
785. A. C. Thibault, Paris—Imp. in the manufacture of paper-hangings, and in the machinery employed therein.

Dated 12*th April*, 1858.

787. S. Bickerton, Oldham—A thermo-pneumatic lubricator for oiling shafts, axles, machinery, &c.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

841. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—A certain medicinal compound for the treatment of epilepsy. (A com.)—17th April, 1858.
842. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved system of portable tents for railway and other purposes. (A com.)—17th April, 1858.
843. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved substitute for the pulverized cotton and wool employed in the manufacture of felted tissues, papers, and other fabrics. (A com.)—17th April, 1858.

WEEKLY LIST OF PATENTS SEALED.

April 23*rd*.

2703. R. Harrild and H. Harrild.
2707. J. Macintosh.
2708. J. Thom & D. McNaught.
2711. Jas. Fairclough, J. Fairclough, and J. Cowan.
2716. J. Ferrabee and C. Whitmore.
2718. W. Clarke.
2721. J. Newall.
2726. H. J. Daniell.
2730. P. A. M. Maury.
2733. G. Shillibeer and G. Giles.
2734. J. Sloper.
2740. John Child and Jos. Child.
2743. R. A. Ronald.
2765. G. B. Galloway.
2768. T. Lowe.
2794. A. C. Sacré.
2801. R. I. C. Dubus.
2811. J. J. Cousins.
2850. A. J. Davis.
2855. S. Webster.
2879. J. Gedge.
2887. E. D. Johnson.
2933. A. V. Newton.
2937. J. Schloss.
2968. F. G. Grice.
2988. J. Summers and D. Wormald.
2997. J. Livesey.
3042. T. W. Willett.
147. A. Bird.
245. R. Carte.
294. W. Armitage.
301. G. Baker and J. E. Baker.
329. W. Thomson.
350. W. Johnston.
422. G. J. Parson & T. Pilgrim.

April 27*th*.

2727. J. Addison.
2741. H. Taylor.
2744. W. Greening.
2746. D. de la C. Gourley.
2748. T. Cook.
2752. E. Smith.
2759. W. Harwood.
2763. S. Knowles.
2774. P. Gabbitass.
2785. J. Apperly and W. Clissold.
181. J. Childs.
359. S. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

April 19*th*.

880. H. Macé.
886. R. Bright.
913. J. Hunter and G. Hunter.

April 20*th*.

892. W. Hadfield.
921. L. A. Avisse.
946. W. Shears.
1071. J. Herdman.

April 21*st*.

903. J. Whitworth.
923. J. Wallace, Junr.

April 23*rd*.

916. M. A. Muir.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4080	April 22.	Chimney Top	T. Parr	55, Lower Union-street, Torquay.
4081	„ 24.	Corset Fastener	J. Pierre and Co.	82, New Elvet, Durham.
4082	„ 26.	Wrought-iron Window and Frame	Burt and Potts	York-street, Westminster, S.W.

Journal of the Society of Arts.

FRIDAY, MAY 7, 1858.

THE SOCIETY'S CONVERSAZIONE AT THE SOUTH KENSINGTON MUSEUM.

Members are requested to take notice that the next Conversazione will be held at the South Kensington Museum, on Saturday (to-morrow) the 8th of May. The doors will be opened at 8 o'clock.

The following divisions of the Museum will be lighted on this occasion:—

1. The Sheepshanks Gallery of Pictures.
2. The Sculpture Gallery.
3. The Architectural Museum.
4. The Animal Produce Collections.
5. The Ornamental Art Collections.
6. The Structure and Building Materials Collections.
7. The Educational Collections.
8. The Collection of Patented Inventions.
9. The Photographic Society's Exhibition.
10. The Art Training Schools.

The following objects will be exhibited to the public for the first time:—

1. A Model, showing the Campaign before Sebastopol, executed by Col. Hamilton, C.B., Grenadier Guards, at the suggestion of his Royal Highness the Prince Consort, for the United Service Institution.

2. Statue of Venus, by J. Gibson, R.A., and the picture of the "Duchess of Burgundy distributing Alms," by Leys (the celebrated Belgian artist), will be lent by Matthew Uzielli, Esq., a member of the Society.

Carriages are to set down at the refreshment entrance. The band of the 1st Life Guards will be in attendance.

TENTH ANNUAL EXHIBITION OF INVENTIONS.

The number of visitors up to yesterday, the 6th inst., was 4,342.

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 5, 1858.

The Twenty-First Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 5th inst., Sir Thomas Phillips, Member of the Council, in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Edgar, George | Lane, Edward
Raynham, Viscount, M.P.

The Paper read was—

IRON: ITS COMMERCE AND APPLICATION TO STAPLE MANUFACTURES.

By Charles Sanderson.

The importance of the manufacture of iron, as a metal required for the various wants of mankind, has called forth the energies of the chemist and the mechanic. It is not found in a metallic state. Nature has mixed the ores of this metal with a vast variety of substances, from which it is necessary to separate them, before they are servicable for useful purposes.

The ores principally used for the production of iron are before you: the black oxides, being generally a mixture of the per and protoxide; the peroxides, which embrace many varieties, as hæmatites, hydrates, &c.; the sparry carbonates, or steel ore; and the earthy carbonates, which are so largely found associated in the coal basin.

It is not necessary for me to give you any detailed account of the localities of these minerals, because this has been recently laid before you, and their geological position has been fully treated. I may briefly remark, that the black oxides and hæmatites, being very rich in metal, are principally smelted with charcoal as a fuel, whilst the earthy carbonates are reduced with coke or coal.

The period at which iron was first produced is lost in the most remote antiquity. At present, it would consume too much time, were I to trace the progress which has been made, from the earliest known mode of production up to the colossal means now employed. Possibly it might be a very interesting investigation, but is certainly not necessary to our present inquiry.

Metallurgy is a science of vast extent in its application, and in its practice draws largely upon the researches of the chemist and the mechanic. Whilst geology and mineralogy direct the inquirer where he may hope to discover the hidden treasures of the earth, they shed a light upon that information which leads to a knowledge of their position, and the state in which they are found; chemistry enables the metallurgist to ascertain both the quantity and the quality of those substances which nature has mixed up with the metal, and it opens a wide and interesting field of investigation, in what manner the metal may be obtained in a useful state, at the lowest possible cost; and mechanical knowledge lends its aid, in the construction of those machines which are required, not only to enable the miner to obtain the ore and fuel, but also to reduce the cost of the subsequent manufacturing operations.

In England, these acquirements have been attained in so high a degree, and the application of scientific knowledge has been so successful, that our iron-works now stand models at once of intelligence and ingenuity.

The progress of the manufacture of iron, from the earliest period to the present time, has been marked by the diligent researches of men of high capacity, whose united efforts have produced the comparatively perfect system we now employ.

The immense iron establishments of England stand pre-eminent, both as regards the mechanical skill which they display, and the practical management which is continually exerted. Machinery is made to produce economy in every department, and a result is thus obtained which appears to defy the competition of other countries. Intelligence and industry at home have enabled us to afford our products at so cheap a rate, that our iron has found a market in every civilised country. If the produce of the soil be looked upon as the greatest source of national wealth, doubtless the metallurgical products of the kingdom stand next in importance, and influence the rise and progress of this wealthy and powerful nation—due to the industry, perseverance, and acquired knowledge of a population whose energies turn to account our mineral riches, by exercising that untiring energy which marks so prominently the English character.

I will not enter upon a detailed account of the manufacture of iron, which has been so often explained, yet I shall be obliged to notice, as I proceed, a few of the processes, because I shall have to remark upon their present state of perfection.

It is in the immense laboratory of the blast furnace that the first operations are carried on for the production of pig-iron. Iron-ore, fuel, and fluxes are charged into the mouth of the furnace in such propertions as shall secure as pure a crude metal as possible.

The first important step is, to ascertain the average contents of the ore, which will be found to consist of certain earths combined with the metal, usually in a state of oxide alone. or oxide combined with carbonic acid. These earthy matters are not found naturally mixed together in such proportions as to secure their fusion—or perfect vitrification, freed from metallic matter. When, therefore, chemical analysis has given the quantity and quality of the earthy contents of the ore, other substances are added, in such proportions as will secure a perfect vitrification of the whole, in their passage through the blast furnace; these are called fluxes.

Iron ores are generally roasted, to open the mass, render it more porous, and at the same time to volatilise the sulphur, phosphorus, or arsenic with which they may be combined. These ores, in a state of peroxide, are charged into the furnace, in certain proportions, along with the fuel and the fluxes.

In examining the chemical changes which take place in a blast furnace, it is very extraordinary that the theory given by Professor Bunsen and Dr. Lyon Playfair has received so little consideration. The various gases which are produced in the different zones of the furnace have been collected and examined, and their action and re-action have been so verified by practical results, that it appears as though no doubt could exist upon the subject, and although chemical principles are clearly set forth, as regards the causes which effect the changes which take place in blast furnaces, yet they, nevertheless, become modified in furnaces differing in form, as well also from the nature of the ores, fuel, and fluxes used.

I will first examine the changes which take place in the passage of each charge of ore-fuel and flux, in its descent from the mouth of the furnace to the dam beneath. I will, then, lay before you the effects produced by the action of the blast upon the fuel, show at what points the various gases are produced, and how by their action upon the ore it becomes changed; thus explaining, as nearly as possible, the rationale of the reduction of the ores into metal, and the union of the earthy matter with the flux forming the slags.

The iron-ore is charged into the furnace as a calcined peroxide. Limestone is added as a flux, to unite with the earthy matter which the ore and the fuel may contain. During five or six feet of their descent, the moisture is expelled; they then become gradually heated to redness, and are prepared for reduction in the first zone of the furnace. Here the ore loses a portion of its oxide, and becomes reduced to a protoxide. These materials now enter the second zone, which ends at the boshes, or widest part of the furnace. At this point the ores are not only completely deoxidised, but become partially cemented. The limestone also has now parted with its carbonic acid, and the alkaline portion unites with other earthy matter, together forming a slag. The whole gradually, but slowly, descends through this part of the furnace, which is made wider, in order that the materials may take a longer time in passing through this space, thus leaving them for a longer period subjected to the action of the carbon. The metallic portion becomes gradually developed, and acted upon by the carbon of the fuel, and the highly-carbonising gases which it meets with in the lower region of the furnace. It then passes the direct action of the blast at the tuyere, and falling into the dam, separates itself, by its superior specific gravity, from the vitreous earthy matter which covers it, and protects it from the oxidising influence of the blast. Such are the changes which each charge undergoes in its passage through the furnace. I will now examine the cause of these changes.

The air which is blown into the furnace is composed, in round numbers, of 79 nitrogen and 21 oxygen. Before this air has risen three feet from the tuyere, it is converted into 65 nitrogen and 27 carbonic oxide; the nitrogen combines with a certain portion of carbon to form cyanogen, and the potassium which is obtained from the fuel, and sometimes from the ore and flux, unites with it, forming cyanide of potassium. The cyanogen is obtained by the union of the nitrogen of the air blown into the furnace, with a portion of the carbon obtained from the fuel, which, uniting with the potassium, is driven through the materials contained in the furnace, rapidly deoxidizing the ore in its passage, and gradually resolving itself into nitrogen, carbon, and carbonate of potash, the former, as gases escaping at the mouth of the furnace, and the latter, which is not volatile, uniting with the descending column of materials, and, reaching that region in which cyanogen is produced, is again transformed into cyanide of potassium. The strongest deoxidizing power is exerted as far as six to seven feet above the tuyere; it then diffuses itself as it rises through the mass of matter found in the boshes. So long as it retains that high degree of heat at which it is volatile, being carried up along with the ascending current of gases, it exerts this strong reducing power, and becomes gradually decomposed; thus, in the second zone, the carbonic oxide becomes the principal cementing medium, whilst in the first zone, this gas, combined with a light carburetted hydrogen which is evolved, commences the decomposition of the iron ore.

From this theory it will be seen, that the heat obtained in a blast furnace is generated in the lowest region, since we find that at three or four feet above the tuyere, all the oxygen injected is actually absorbed, giving rise to highly heated reducing gases, which, by the pressure of the blast, are in a manner forced through the furnace.

In all the theories which have been advanced respecting the cementation of the ores reduced in the blast furnace, this very important action of the cyanide of potassium has been neglected; yet from the first blowing in of the furnace it exerts an active decomposing influence, and as the furnace continues to work and the potassium to accumulate, the volume of cyanogen becomes necessarily increased, and although formed in the hottest region, its influence spreads over a large portion of the lower part of the furnace, and this action is the theory of what in practice is called getting the furnace into good working order. Such is the theory of those changes which take place in blast furnaces during the process of smelting.

As regards the construction of furnaces, generally speaking, they should have an internal form favourable to the gradual reduction and diminution of the volume of materials charged, which it is important should be so mixed that the earthy matter of the ore and the flux may readily unite; the descent of the materials in the furnace is regulated by the inclination and width of the boshes, and necessarily this inclination or width varies according to the nature of the ore which is to be smelted —those which are most easily reduced require the boshes to be the most inclined, whilst those which are difficult of reduction, and consequently require to be subjected to the action of the carbon of the fuel and the gases which are generated, for a longer period, are retained in this part of the furnace by greatly increasing its width, and giving the boshes a greater inclination.

In explaining this action of the blast-furnace, I have shown how the metal is reduced and carbonized, from which it will appear how difficult it is to obtain a pure metal, because, as it becomes developed in the lower regions of the furnace, it is necessarily mixed with substances forming a variety of metalloids; besides which, it is mechanically associated with the slag, which protects it in the dam from the oxidizing influence of the blast, through which it descends, carrying also with it a mixture of unreduced matter, which, from its gravity,

becomes more or less mixed with the metal when it is in a state of pig-iron.

Although the blast furnace is the most effective, and also the most economical, for reducing iron ore, yet we find that there is an actual loss, equal to 80 per cent. of the effective usefulness of the fuel. This fact is arrived at from the theory I have laid before you of the formation of gases in the furnace, taking the melting point of pig iron at 2192 Fahr. The fuel used together with the blast injected into the furnace, will give the quantity of carbonic oxide, light hydrogen, &c., which, when burned with heated air, would be sufficient to reduce or melt a given weight of iron from its ore, which in theory is estimated at between 16 and 17 per cent. of the value of the fuel consumed. These gases, so largely produced, are now collected in many works by means of pipes variously arranged, and inserted a few feet below the mouth of the furnace. They are used, mixed with a certain portion of atmospheric air, as a fuel for raising steam, heating the blast for the furnace, and on the Continent for the purposes of puddling; also for drying and carbonising the ore prior to its being charged into the furnace. If these gases are taken as they arise from the furnace, I see no objection to their being applied to useful purposes, but I do object to even the least forcible means being used to draw them from it. No current ought to be created in any apparatus which may be formed for conveying away these gases, since it would cause them to pass too rapidly through the furnace, and thus prevent them from producing their full effect upon the materials through which they are made to pass. This utilisation of the waste gases is highly interesting, and presents a wide field for application, besides which there is an evident economy to be obtained from their use, provided they are properly withdrawn from the furnace.

In the reduction of iron ores, it is very inportant to obtain the resulting metal in a state as free from deleterious matter as possible. To effect this, the ore is roasted to disengage all volatile matter and disintegrate the mass, such fluxes being used as shall, in the process of smelting, form vitreous compounds, by entering into combination with the earthy matter contained in the ore and fuel. Instead of giving any chemical formula, in order to show the relation one earth has to another, or the exact proportions of each which are required to form slags of sufficient fluidity, I will suppose that an iron ore be taken of a silicious nature and smelted alone, the result would, of course, be a silicate of the oxide of iron, like finery cinder. We will look upon this combination as that of an acid with its base, the acid being combined with the oxide of the metal. In order to liberate the metal, this combination must be decomposed by some other alkaline bases which have a greater affinity for the acid, and unite with it, forming new compounds, at the same time liberating the metallic oxide; so it is in the blast furnace. Iron ores become soft during the process of deoxidation, they eventually melt, and in that state require to be in immediate contact with one or more alkaline bases, so that they may prevent the formation of the silicate which would otherwise take place. Limestone is the matter used for this purpose; it is well adapted to the object, but, in my opinion, the large amount of carbonic acid which it contains is prejudicial, because, in its descent, volumes of this gas are given out, which absorb a large portion of the heat from the materials in the furnace, thus cooling the region where such absorption takes place, and often producing very serious derangements in the working of the furnace. Since a certain amount of alkali is required to saturate the silicious matter, that object would be best attained by introducing such alkali in as condensed a form as possible. I am therefore a strong advocate for the use of caustic lime instead of limestone, because the carbonic acid which forms 40 per cent. of the bulk is not wanted, and it is a waste of fuel to heat so large a mass of what may be called sterile material. Salt has been proposed as a flux, and in small doses will be found very beneficial.

Sir Francis Knowles, struck with the functions of the cyanide of potassium, proposes to introduce potash, felspar, or soda into the furnace charges; he adds lime, equal to two-thirds of the weight of the silica contained in the felspar; the bases then become lime, alumina, and the alkali, which being in excess, is released to form the cyanide required; he states that his trials have given him a cinder entirely free from iron; he has also patented the use of kaolin or china clay as a flux; this substance consists of 47 per cent. alumina, and 52 per cent. silica, so that even when the silica is neutralised there yet remains 30 per cent. of alumina to act upon that contained in the ore; kaolin is thus much superior to shale, which only leaves about 10 per cent. of free alumina after the silica is neutralised. I believe some experiments are now going on to smelt forge cinders with kaolin, and, if they are successful, this substance may be beneficially applied to all silicious ores. He further proposes to deoxidize the rich ores prior to their being charged into the blast furnace, by charging them into large retorts heated cherry red, and passing through them a current of carburetted hydrogen gas, which he obtains from the coke ovens; he finds that peroxides can be thus converted into protoxides in two hours, and that in three or four hours they assume the appearance of metallic iron; ore so prepared, he states, will at once go down as grey iron on arriving at the boshes; as an economical means of carbonising the ore, he takes the waste gases of the furnace and passes them in a highly heated state through the fuel to be coked; the gases evolved are stored in a gasometer for use.

Many ingredients have been from time to time proposed for improving the quality of crude iron, but acting as they do upon so large a mass of matter, but little benefit has yet been derived.

The pig iron which is produced from blast furnaces varies in quality, that is, the iron is more or less mixed up with matter which is not metallic, whilst the iron itself contains more or less carbon. In charcoal furnaces, in which the rich ores are generally smelted, and in which the fuel is not so strong as coke to withstand the strong blast, or the superincumbent pressure of the ore, great care is required in adjusting the burthen of the furnace; if a heavy burthen of ore be used, with a view of obtaining cheap pig iron, using only a small portion of fuel, it is very evident that the ore will pass too rapidly through each region of the furnace; it thus retains and carries with it a large portion of deleterious matter, and but a small dose of carbon; such metal is thus unfit for casting purposes, and when manufactured into malleable iron produces much waste, and retains all the bad properties which the metal contracted in the blast furnace.

The trade divides the qualities of pig-iron into numbers, 1 to 4; the more carbon it contains the more fluid it becomes on melting. No. 1, is that most highly carbonized; 2, 3, and 4, contain each a less degree of carbon, whilst the common white iron contains only a small portion, having been made to pass too rapidly through the furnace, and consequently become mixed with much deleterious matter. Nos. 1 to 3 are principally used for casting purposes, whilst No. 4, and all metal less carbonized, is used for the manufacture of rails, and common malleable iron.

There has been much controversy as respects the relative strength of hot and cold-blast iron; I do not propose to give at length the reasons alleged by the supporters of the superiority of either kind; but I wish to observe that, inasmuch as iron becomes stronger in proportion as the metallic molecules of which it is composed are brought closer together, it appears to me most probable that pig-iron produced by cold blast, and under such circumstances as to ensure the production of the purest iron, would be most likely to produce the strongest material for casting purposes. With this theory, as re-

gards the strength of iron, I must at present leave this most important matter, although much more might be said upon a question which has been too often the cause of serious accidents, but which involves so much minute inquiry that my time will not allow me to say more than to express the opinion, that pig-iron may be materially improved for casting purposes, and made much stronger for mechanical and engineering objects, as well as the no less important purpose of ordnance. I base this opinion upon the theory I have just advanced, that iron increases in strength in proportion as the molecules of the metal are brought closer in contact, without producing crystallization; and this can only be effected by discharging a large portion of that deleterious matter with which the metal becomes associated during its production in the blast furnace, and, as iron for casting purposes can be thus improved, its application will be materially increased.

In the foregoing, I have endeavoured to explain the theory of the production of pig-iron in the blast-furnace, and, at the same time, have endeavoured, as far as possible, to make this theory agree with every-day practice, although I have condensed the subject into the smallest space, yet I feel how very little my time has allowed me to lay before you, upon the manufacture of a metal which finds employment for so large a portion of our population. The plans which have been proposed for the utilisation of the waste gases are a subject of great interest, since this is the only step which has been made to recover the effect of that fuel which is now lost. The relative effects of coal as a fuel, instead of coke or anthracite, I have not been able to touch, whilst the use of fluxes I have simply reduced to a general theory. I trust, however, that these points will be taken up by others, since they are sufficiently important to form separate papers for discussion before the Society, the principal aim of which is, to advance the improvement of our staple manufactures; and this can only be done by eliciting from practical men descriptions of processes generally in use, and particularly encouraging improvements.

Pig-iron I assume as the crude raw material from which its staple manufactures are produced. A very large proportion of the pig-iron made in this country is converted into malleable iron. Common iron and rails are made from the cheapest descriptions of pig-iron, but for the better kinds a superior pig is used, and for the best iron refined metal alone, or mixed with charcoal pig-iron. In those works in which common iron is made, the blast furnace manager's talent is exercised in keeping his furnace exactly in such a state as is favourable to the production of a maximum quantity of iron, with the least possible consumption of coal, or waste of the materials used. Under such circumstances, it cannot be expected that a pure iron will be produced, the effort made to obtain quantity necessarily affecting the quality.

In the manufacture of merchant bars, and iron of similar quality, pig-iron is charged directly into the puddling furnace, and is subjected to a process called boiling. Malleable iron thus produced is much inferior in quality to that obtained from refined metal, because all the deleterious matter which the pig-iron contains, being mixed up with the metal as it is being puddled, necessarily becomes more or less incorporated with it, and materially affects the quality of the puddled bar. Being alloyed with the silicated slags produced, its power of tenacity and strength becomes weakened. The waste in the puddling furnace is very large, and this loss is again seriously felt in all its subsequent manufacture, being caused by the absorption of a large portion of metallic matter by the slags produced from the impure iron. I have been told by the chief managers of two of the large Welsh works, that they had, on an average throughout the year, consumed 28 cwt. of pig-iron in the production of every ton of railway bars. In the manufacture of malleable iron, we find the cost consists of coal, labour, and the crude metal employed. If the puddling furnaces are well-constructed, no material economy can be made in the present consumption of coal, and in the ordinary state of trade no reduction can be expected in the cost of labour. If, therefore, economy is to be made in the manufacture of malleable iron, it must be by a reduction in the waste of metal which is now experienced in puddling and other furnaces used in iron-works. In Wales, this large waste is experienced by the use of a low carbonised white iron, containing much foreign matter; but in Scotland, a similar waste results from the circumstance that the pig iron is too highly carbonised, from which cause it has to remain much longer in the puddling furnace before it can be brought into nature. This prolonged application of the heat produces so large a waste, and entails such heavy work upon the puddler, that in Scotch malleable iron works it is the custom to refine part of their pig iron in order to get rid of a portion of the carbon, and thus accelerate the puddling process. The intermediate plan of refining pig iron has been introduced between the blast and the puddling furnace, in order to clear away, as far as possible, that foreign matter which it has taken up, as well as to dissipate a portion of the carbon, but since it is absolutely necessary to keep the cost of the production of bars or rails within a certain limit, it is imperative upon the manufacturer that such operation shall entail no ultimate expense, and this can only be effected by reducing the waste of iron so low in the puddling and reheating furnaces, that the weight saved shall compensate for the expense of refining. The present plan for producing refined metal is very costly, averaging 15s. when pig iron cost 70s. per ton. This becomes a serious charge upon the metal in its earliest stages of manufacture, and although malleable iron made from refined metal is much superior to that made from pig iron, yet owing to the great expense of refining by the usual process of a strong blast, together with the waste experienced, and cost of fuel and labour, the prime cost of the finished bar becomes so seriously affected as to prevent its general use. I have devoted considerable time and expense to this desirable object, and I have succeeded in producing a highly decarbonised refined metal, at a cost not exceeding 5s. to 6s. per ton, including waste and every other expense. This metal produces a puddled bar with a waste of only $1\frac{1}{2}$ cwt. per ton upon very common iron, and as low as 1 cwt. per ton, if the refined metal be made from strong forge pig iron. Upon a calculation, based on the manufacture of 100 tons of Welsh iron, re-melted from the pig, $\frac{1}{3}$ being white iron, and $\frac{2}{3}$ mottled pig, the waste in refining was 90 lbs. per ton, and upon a quantity of 60 tons, drawn directly from the blast furnace in a fluid state into my refining furnace, a loss of only 60lbs. per ton was experienced.

Two furnaces in one of the large Welsh iron works puddled this refined metal for twelve consecutive days, and the average waste during that period was only 84 lbs. per ton; the pig from which this iron was made had no cinder in its composition. I present for your examination several samples of this refined metal, which is produced with the greatest facility; also of the slags which result from it. The objects of this process are to reduce the loss of metal, and to use coal instead of coke as a fuel; to effect a uniform decarbonisation of the pig iron without the use of blast, to use a chemical reagent capable of giving out oxygen during its decomposition, which, taking up and uniting with the carbon evolved from the metal, produces carbonic oxide gas, and this, acting upon the earthy compounds contained in the pig iron, precipitates the metal contained in them, by which means I obtain very clean, pure, crystalline metal, capable of being manufactured into superior malleable iron. There are samples of malleable iron manufactured from this refined metal, also a sample of the pig iron used to produce the refined metal, several tons of which were puddled in Yorkshire and rolled into rivet iron, which was used for rivets in the *Leviathan* steamship, and reported

of excellent quality. This iron when finished experienced a waste of only $3\frac{1}{2}$ cwt. per ton. By this process I refined a mixture of 15 cwt. of number 3 hot-blast pig, and 6 cwt. of cold-blast charcoal iron; the metal was puddled and rolled directly into a bar, then converted and melted into cast steel; the files and saws which are exhibited were manufactured from this steel, and show the purity of the metal from which they have been made. The gun-barrels are made from the rough puddled bar above mentioned, melted without conversion. These two samples were manufactured under the inspection of one of the government officers for small arms, at Birmingham, and have been tested at the proof house. There are several other samples of this quality of iron; it is somewhat expensive, but it is the purest iron which can be produced, having been melted and thus divested of all its foreign matter. It is a proof also of the great additional strength which iron acquires when the metallic particles are made to approach close to each other. My refined metal has been successfully tested for tin plates There are samples of this iron made in the puddling furnace, and refined with charcoal, in both instances the waste was reduced one-half when compared with pig iron. The tin plates manufactured from it are reported of good quality. The metal has also been found equal in quality to charcoal pig iron when used for the manufacture of very common cutlery, called run steel. The articles before you will show that it admits of being hardened and tempered.

In making castings, whilst additional strength can be given to iron by cleansing it from earthy matter, yet care must be taken that in reducing the amount of carbon, the metal does not crystallize; a fine grain is favourable to great strength, which can only be attained by the purification of the pig-iron itself, when very strong castings are required. I recommend that the pig-iron which is used should undergo a remelting, adding such reagents as will unite with much of the earthy matter contained in the pig, but which will not extract the carbon; such iron will make stronger castings, because the metallic particles are brought in closer contact; I find also from experience that an addition of my refined metal to such purified iron will give still greater strength.

Highly refined metal is not fit for castings; it is as bad as the use of hard cast steel, because the disaggregation of the mass, arising from crystallization, weakens the whole body.

Much has been advanced in favour of the manufacture of ordnance from cast-steel. I do not think that good and serviceable pieces of artillery can be manufactured from such metal. There is no great practical difficulty in casting a mass of steel 2 or even 3 tons weight, but the irregular crystallization of so large a body of steel, melted in parcels of 50 lbs. in a crucible, is unfavourable to that uniform molecular structure which such castings should possess, since upon their excellence often depends the issue of a siege or action.

Although wrought-iron ordnance cannot be depended upon, they are better than cast steel, but their perfection is much impaired by the necessity of piling masses of iron together. I admit that a weld can be perfectly made, but two surfaces when oxidized can never become one amalgamated body, without the oxygen be reduced at the moment when the union is effected. Wrought-iron guns have given excellent results when fired at slow intervals, but if a continuous quick firing were kept up, I doubt their being able to withstand the shocks; they would, I think, after each round, become gradually weaker throughout the welded surfaces.

It appears of very great importance that some means should be devised for producing a material combining the greatest strength with durability, not only for the construction of rails, but also for tubular bridges, steam-ships, and a great variety of similar purposes, not only to prevent loss of life, but also to secure an eventual economy. No plan appears so effective as that obtained by the union of iron and steel; such a compound metal will, I believe, furnish a better and a cheaper means of effecting this great object than by the use of iron alone. Large masses may easily be obtained through the medium of the welding property of cast steel in a fluid state. A bloom of iron is heated white hot, placed in a cast-iron mould, and fluid steel is poured against it; the effect is, that the carbon of the steel reduces the oxide on the surface of the iron, and a union like that of silver plated on copper is obtained, rather than a common weld. Two pieces of iron may thus be united, by pouring cast steel between them when heated, forming a mass of great strength, and useful in machinery, where considerable strain is exerted, on account of the stiffness and strength of the steel being united with the toughness of the iron.

Now, more than ever, we require the means of rapid transit in our Indian possessions, to enable us to retain our supremacy in that distant portion of our empire; present experience shows us that we must take immediate measures to enable us to concentrate at any one point those means of resistance which must, in future, be kept at all times ready to protect both life and commerce. To do this, main lines of railroad must intersect the length and breadth of India, whilst light draught steamers must open out an inland navigation which does not now exist. A compound metal of iron and steel, from its combined strength and lightness will, I believe, furnish a better and a cheaper means of effecting this great object than any which can be obtained by the use of iron alone. I beg to submit to your notice a new form of rail; it is made from a thick plate of iron and steel united as described; the plate, when hot, is bent up into the form of a rail, the steel coating being outside, before the bar is cold; it is hardened by being plunged into cold water and tempered in the usual way; by these means are obtained, not only great combined strength by the union of the two metals, but a further addition of it, equal to 33 per cent., is made by hardening and tempering the steel, which not only prevents the running surface from rapid wear, but, what is of the greatest importance, such rails can never laminate—the elasticity acquired by the hardened and tempered steel portion of the rails will prevent them from setting when bent by sudden and undue pressure; they can be made of any thickness, according to the nature of the traffic; the main line might be laid with rails like the thicker model, which is equal in strength to the double-headed rail now used, which weighs 84 lbs. per yard; but many districts might only require rails like the lighter model. The advantages this rail presents are great strength, great resistance under undue pressure, a hard non-laminating surface, which will wear very much longer than those now used; but the most prominent value is their extreme lightness, combined as it is with great strength, which becomes of such high importance in the first cost of a railway. The rail of the heavy model is 36 lbs., and that of the light one 26 lbs. per yard; if you admit for a moment that my statement is true as respects their strength and other qualities, allow me to suggest to you the valuable advantages which such a rail presents in point of economy, and the large saving made, especially to colonial railway companies, not only in freight from England, but the more serious expense of inland transport. I will not go into the various forms which engineers might think it best to give to rails made from such material, but there does seem to me one great advantage in the mode which I have adopted to attach the rail to the chair. The model of the saddle rail is like that used on the Great Western, but it is stronger on account of the material used. In countries where wood is cheap, a modification of this rail might be laid down very economically.

I propose the use of iron and steel united in a bloom, and subsequently rolled to a sheet, hardened and tempered in order to obtain the maximum amount of rigidity

combined with strength, as a material for the formation of steam ships; and it will be found equally useful in the erection of tubular bridges, and many other engineering purposes.

In these days of steam navigation, I would request of those who are engaged in building iron steam-ships to investigate the usefulness of such material, and to inquire into its cost. No doubt it may be expected to be expensive. I am enabled to state, however, that it can be produced at a sufficiently low price to ensure its use, and whatever increase there may be in cost, will be more than compensated for by the difference of weight required of this material contrasted with that of iron.

The value of puddled steel has recently been brought under your notice. I can add little to the opinion I then expressed; the process will certainly produce steel, but from the nature of the operation itself, it must be evident that the quality is continually subject to great irregularity. All agree that the greatest care is necessary to produce it. More uniformity may be obtained by breaking up the rough bar, selecting them when cold, and welding them together; still the mass is simply steel combined with fine fibres of iron intimately intermixed. It will become a useful metal for a great variety of purposes where a cutting edge is not required, but looking at puddled steel as a raw material to be manufactured by the peculiar process which has been described in the patent, I still think that if refined metal were puddled, shingled, and rolled to a bar, and then converted into steel by the usual process, a cheaper and more uniform material would be obtained. I take this opportunity of repeating, that the conversion of bar-iron into steel ought not to cost more than 18s. per ton. My calculation is drawn from careful accounts kept of the working of ten converting furnaces for five years, during which period one-half of the iron was converted for hard melting purposes. From this, I positively affirm that the conversion of puddled bar-iron, in order to give it as much steel character as that possessed by puddled steel, ought not to cost so much as 18s. per ton, including every other expense.

Some engineers have objected to rails, even if made from cast steel. They say no dependence can be placed upon such a material, because it has no toughness. Its crystalline fracture is objected to, on account of brittleness, especially in very cold climates. The form of rail which I have submitted to you might, of course, be made wholly from steel, but I object to this material, because rails are subject to sudden violent concussions, which might snap a steel bar, and thus place the line in danger.

For some time past our scientific journals have been filled with various projects for the production of steel, especially cast-steel, at very cheap rates. After all the apparently feasible projects which have been suggested, nothing of any importance has yet been done to attain this object; the steel which has been produced by these various processes does not appear to possess that quality which has been so positively stated; hitherto cast-steel has been made varying from £65 to £30 per ton, each quality being practically useable for the manufacture of steel articles. The manufacture of such steel has hitherto been the peculiar province of the Sheffield makers, but let it not be supposed that they can make no other material than that used by the cutler, the tool maker, and the engineer; let them see that a want is created for a steel suitable for the manufacture of shafts, steam ships, tubular bridges, and other like purposes, where strength and rigidity are the principal acquirements, it will be found that they are the best able to suggest modes for producing such an article, of uniform quality and at a cheap rate. Science can greatly assist art in producing the kind of steel required for general engineering purposes; and highly as I esteem this combination, I would earnestly advise the practical metallurgist not to come to hasty conclusions from laboratorial experiments. With the metal steel is associated the idea of great expense; good steel will always sell at a price consistent with its intrinsic quality, and, if care, skill, and expensive raw material be required to produce such a steel, an adequate price will always be found for it; but, if, on the other hand, a metal be required combining within itself a much superior strength and rigidity than iron possesses, I feel no hesitation in saying that it can be produced by the large steel manufacturers of Sheffield at a cheaper price and of a better quality, than by any of the peculiar processes patented within the last few years; although I do not think that a process is yet discovered which secures the minimum cost price of the production of such material, yet this enquiry is going forward, and will, doubtless, be speedily arrived at. Whether such discovery emanate from existing steel-makers, or from others, not engaged in this trade, its production, at a cheap rate, will confer the greatest benefit, not only upon our railroad requirements, but also upon our steam navigation; we may then hope to have better and more efficient rails, stronger bridges, and safer steam-ships.

As regards the direct conversion of pig-iron into malleable iron or steel, without the pudling furnace or charcoal refinery, I have already expressed a strong opinion, when that process was first proposed, at the meeting of the British Association, at Cheltenham.* I still see no cause to change the opinion I then expressed, that neither practically useful malleable iron, nor cast-steel, could be produced direct from pig-iron. It is by no means a common practice to use refined metal (which is decarbonized pig-iron), as a mixture with any common material, such as scrap iron, clippings from old boiler plates, and the like, to produce a common cast-steel, which is sold at from £16 to £18 per ton, for making mill saws, and several very common cast-steel articles, but the only quality, as a steel, which it possesses is, that it will harden and temper.

When it was found that the decarbonized pig-iron, resulting from the process of blowing a strong blast of air into a body of fluid iron, would not roll or draw under the hammer, Mr. Robert Mushet patented several processes, with a view of rendering this product malleable; manganese, mixed with carbonaceous matter, is suggested by him as a means of obtaining malleability; he asserts that he can operate upon one or twenty tons of fluid metal, by blowing a strong blast into it, and when, by this means, it is decarbonized by adding from 2 to 20 per cent. of manganese and carbon, he professes to change a brittle metal into one capable of being rolled, or hammered, hardened and tempered. There is a sample of Mr. Mushet's steel, but I have no information as to whether it has been produced in the manner described, or whether he has had recourse to the crucible to remelt this metal.

A patent was taken out a short time ago for mixing decarbonized metal with malleable iron; this process was first carried out at some cast-steel works belonging to Prince Schwartzenburg, at Muraw, in Styria; the late Mr. Heath also used it at his works at Chelsea; in both these instances, although the finest charcoal metal was used, yet a good quality of steel was not regularly produced; as a manufacture, the process was imperfect.

Patents have also been taken for the production of cast-steel from iron ore; many experiments have also been tried, both in England and France, to produce a cheap steel from such an inexpensive material; by Monsieur Chenot's process, the iron is separated from other deleterious matter by an electro-magnetic machine; to the material so obtained, a thick lime water is added, to prevent the particles sticking together, and forming a compact mass during the process of deoxidation, which is performed in small perforated iron vessels, by passing through it a current of carbonic oxide gas; this deoxidized spongy mass is then steeped in any kind of fatty matter; from this source, he says he obtains the constituents of steel; he proposes also to condense the spongy matter by pressure, and submit it to the usual process of cementation; it is then to be melted into cast-steel.

There has been much said respecting a process for

producing cast-steel from a mixture of spathose iron ore and granulated cast-iron; but from the reasons I shall shortly lay before you, I think no successful or practical result will be obtained.

Sir Francis Knowles has also patented a process for making cast-steel from iron ore; he says, that if the complete success of the process be doubted, it is impossible to deny that it rests upon a theory both rational and consistent with chemistry; he looks upon the manufacture of cast-steel from British materials as of national importance, by rendering us independent of Sweden, or any other country. There is before you a complete set of samples of this steel, also a variety of manufactured articles, from which you can judge of the progress which he has made. His theory is as follows:—If the oxides of iron be placed in a closed retort or crucible in contact with charcoal, and submitted to adequate heat, the metallic part, as soon as it is deoxidized by the charcoal, begins to absorb carbon, and is, in fact, converted; if then no more charcoal be admitted than is exactly sufficient to deoxidize the ore, and to convert the metal to the required temper, it is plain that the absorption of carbon will then cease; and if at this stage the heat be gradually raised to the steel melting point, the production of steel must be the inevitable consequence. In sending the examples I am enabled to exhibit, he observes, in order to adjust the charcoal, we must know how much metal there is in the ore, and what is its state of oxidation; preliminary chemical analysis will settle this point. The next step is so to adjust the fluxes, that protosilicate of iron may not be produced, and for this purpose chemistry must determine what earths are contained in the ore and the fluxes—a calculation must then be made, so that the aggregate may be a combination of the silicates of alumina, lime, magnesia, and the potash of the charcoal used. Magnesian dolomite calcined is preferable; in its absence the purest lime is to be used; the other flux he uses is kaolin, which is so rich in alumina; there is an additional value in this, as it prevents the corrosion of the pots, when in proper quantity. The best ratio of the earths is three silica, two alumina, two lime; samples of the cinder are here for inspection, being pure and free from protoxide of iron. The most striking feature of this "ore steel" is it very great density; this he ascribes to the total absence of the protosilicate of iron in the cinder. Amongst the articles is a chisel, taken from an ingot; merely ground, and hardened, and tempered, it has cut to pieces a bar of file steel. This striking property has led to its employment for the cogs of wheels and other important purposes. He also uses the Greenland cryolite, and cyanides of sodium and potassium, as fluxes. He has also contrived a furnace or cupola for making steel by this process; it resembles an ordinary blast furnace, except that the materials, mixed in proper proportions, are carefully secluded from the fuel, and descend through a long pipe of refractory fireclay, and through the various degrees of heat required, to the hearth of the crucible. Whether steel can be directly cast into ingots from such a furnace is at present doubful; but there cannot be a doubt that a steel metal will be obtained. Sir Francis Knowles does not disuse altogether the present method of conversion; on the contrary, his opinion is, that, for certain purposes, it is the best and most economical, as for some of the milder tempers—but whenever the operation of melting is required at an intermediate stage, there he would substitute the direct method, and, above all, for cutting tools, of every description, and the highest class of cutlery. Such is Sir Francis's own statement.

The foregoing are the prominent processes which have recently attracted public notice, having for their object a reduction of the prime cost of making cast steel.

As regards all steel produced by the decarbonisation of crude iron—if we examine the peculiar state of this metal it will be found, that the mass is composed of atoms irregularly decarbonised and impure; besides which, we find in such masses of metal a variety of combinations, all of which are opposed to malleability, because the aggregated molecules of such mass are not homogeneous, but are mixtures of metal existing under different chemical circumstances, which give to each molecule a different crystalline structure, so that, when heated, they expand unequally. All these opposite and conflicting states, in which decarbonised pig-iron is found, prevent the mass from drawing or rolling. If lumps of iron are drawn from the puddling furnace a little before the mass is balled up, a bright and crystalline metal is obtained, similar to this decarbonised crude iron; it is partially malleable, but it has no fibre to recommend it as an iron, nor has it carbon, to entitle it to be called steel. Mr. Mushet has evidently the idea that the addition of his compound will produce one uniform crystallisation, favourable to malleability, and he appears to expect that an alloy will be found of metallic manganese with the iron, but analysis has shown that no such alloy does take place. Manganese, added to steel, in the crucible acts simply as a detergent; it cedes its oxygen to the silex, which the silicates of the metal may contain, and oxydises it; a union then takes place, producing a silicated oxide of manganese, in the form of a glassy slag; the metal becomes thus purified, because all foreign matter is separated, forming new compounds, which cannot again unite with it. In any attempt to produce cast steel from decarbonised pig iron, it must be broken up when cold, and such reactives added to it when charged into the crucible as shall take up the deleterious matter and liberate the metal, which must be kept in a fluid state for a long time, until every particle is reduced to the same chemical condition, and thus rendered more favourable for malleability; but this is so nice an operation, and so dependent upon uncontrollable circumstances, that it is not reduceable to practice.

As regards all those processes which have for their object the manufacture of cast-steel from iron ore, I may in part advance the above theory against their success, but there is another cause which operates very unfavourably. Iron ore may be deoxidised and used as M. Chenot proposes, or it may be charged into a crucible along with carbonaceous matter and fluxes, and slowly heated until deoxidation takes place; when the cementation is complete, a mass is obtained in the crucible consisting of earthy matter intimately mixed with steelified metallic particles, all which have to be melted down into one mass. I think no one can reasonably assume that all these metallic particles, intimately mixed as they are with the earthy matter, can be in the same chemical condition, nevertheless the metal must all be melted down in this imperfect state; the metallic part more or less carbonised and mixed with foreign matter falls to the bottom of the crucible, simply from its superior specific gravity; in order to give every chance for the matter to clear itself and become uniform, it might be kept in a melted state for some time, but for all this the operation carries with it no certainty either as regards quality or temper. I manufactured a ton of ingots from a very pure black oxide of iron; using every possible care, not more than 7 cwt. could be drawn into bars at all, and the fracture was very irregular, which may be observed in the sample; a part of this steel would not draw, but broke in pieces; the rest drew more or less imperfectly, and, on a careful examination, I found it very evident that the chemical condition of the metallic particles was so dissimilar that malleability could not be depended upon. In order or as far as possible to prove this assumed case of irregular malleability, I took soft steel in one crucible and very hard steel in another, and mixed with each a quantity of earthy matter, as nearly as possible to imitate the condition of the iron ore when melted; when they were completely melted they were intimately mixed together, and an ingot was cast; but although very carefuly heated it would not draw; this was not because any earthy matter was mixed up with the metal, but because its carbonization was variable throughout the mass, which gave rise to such a confused diversity of crystallization, and caused so great a difference in the

degree of malleability of the atomic structure of the mass, that the action of the hammer at once broke up the ingot; the want of tenacity or disaggregation of the mass is often seen in large ingots, although made from good material; this is caused either from the irregular temper of the steel used, or from its having undergone a complete change in the crucible by over heating it, and thus causing a mixed crystallization; or it may equally arise from being under melted, which it is evident would produce the same effect. As I have stated, ingots of cast-steel can be produced directly from iron ore, but the best portions harden very irregularly, whilst the mass is usually so imperfect as to be unmerchantable. I admit that a cheap metal may be produced, but, as I have shown that there is no certain result to be obtained in its manufacture, so also there is no economy. I will not assume that those who have been so sanguine in the production of cheap steel can have expected to produce a superior quality suitable for the best purposes; I cannot suppose such to have been their object, but rather to obtain a cheap material in a fluid state, capable of being cast into large masses for engineering purposes, or objects which are now manufactured from malleable iron—such as shafts, beams, girders, plates for ships' bridges, &c., &c. In a commercial point of view, England is the only exporting country to any extent. Sweden sends to England about 30,000 tons annually for steel purposes; she also exports largely to India and North America. Russia also exports to England about 10,000 tons of steel iron; a portion is sent to the United States in bars and in sheets, which are manufactured by a peculiar process, having a very fine black polished surface; the rest of the produce is either consumed within the empire, or finds a market in Asia Minor and the East. Prussia has, within a few years, largely increased her production, and still continues to expand; she has not, however, exported her produce, but, on the contrary, has required considerable importations of pig iron; for in 1857 she received from England 67,297 tons, against 39,296 tons sent in 1856, being an increase of 28,001 tons, and equal to 67½ per cent.

France does not appear to have made any advance since the alteration in the tariff admitted English iron at a reduced duty, which all her iron masters are now seeking to repeal; it will, of course, become a national consideration, whether they are to hold the monoply they seek, or whether the manufacturing population are to maintain their position—since the cost of iron in most countries is now becoming, as it were, the standard of its riches. In 1856 she imported from England 84,923 tons of pig iron; in 1857, 89,401 tons, making an increase of only 4,478 tons; whilst of rails and bars, in 1856, she imported from us 71,344 tons, and in 1857 only 30,136 tons, showing a large decrease of 41,208 tons. In the United States, although many of their iron works are not in operation, and others, like our own, at present doing very little, yet, in the early part of last year they were producing one million of tons of pig iron per annum, and from their vast mineral resources they will again, after a time, go on increasing; they do not export—on the contrary, in 1856 imported 58,500 tons of pig iron; in 1856, 46,752 tons, showing a decrease of 11,748 tons; again, in rails, bars, &c., in 1856, they imported 231,555 tons; and, in 1857, 221,430 tons, showing again a decrease of 10,125 tons. In sheets, plates, &c., in 1856, 45,714 tons were exported, and in 1837, 46,497 tons; giving a small increase of 783 tons. On the whole, therefore, it appears that their own resources have reduced the import in 1857 to the extent of 20,000 tons, this reduction may, however, have partly arisen from the existing state of their public works and general trade.

The exports to all countries, for the first three months of the present year, show a decrease upon 1857 of 149,021 tons. The decrease has been chiefly to the United States, being 118,236 tons out of the whole. The total decrease of our exports this year is 31 per cent., equal in money to £1,447,479.

If, then, we take a review of the iron produced in different countries, we find that the charcoal iron produced all over Europe, is either consumed in the country where it is made, or sold to neighbouring states. Prussia, France, and the United States, alone make iron from coal or coke, but they do not export. England stands alone; her immense product supplies the want of every kingdom and nation. How is it that we have secured a position over all other countries, which enables us not only to supply iron cheaper than they, but also to pay the expense of transit, import duties, and a variety of other charges, and still compete with their own producers in their own markets?

We are fortunate in possessing large deposits of ironstone and coal, but we are still more fortunate in possessing the highest intelligence, an industrious population, and unlimited pecuniary means for carrying out the production of iron upon the most extended scale. In mining, in the management of the blast furnace, and in all the various processes for the production of malleable iron, knowledge has been added to knowledge, experiences have been so multiplied, and the system of iron making is now so perfect in itself, that by the statistics of the British iron trade, we find England exporting iron and articles made therefrom to the enormous amount of £22,994,671, finding employment at home for a large industrious population, and supplying freight for our own merchant navy. This state of things will not only continue to exist, but our exports must continue to increase, so long as, by our industry, capital, and knowledge, we continue to produce iron at so cheap a rate. Improvement in quality is highly important, if it can be combined with the economy now practised, and must give an additional security to our commerce. Iron masters may say, our plate-iron and our rails are good enough; I fear such an assertion could not be upheld; our rails, generally speaking, are not so good as they can be made, and the almost daily reports which we hear of the defects of our iron built steam ships, are proofs that this kind of iron might be improved, and this can only be done by giving the maker a better price. I am perfectly aware that to maintain our supremacy over other countries the most rigid economy is necessary, but if our large iron makers hope for prosperity, and if those who embark such large sums of money in iron establishments look for a manufacturer's profit, they must be careful how their money is expended in mines, machinery, and general works; they must avoid the incubus of a heavy dead capital. Certain works may be able to produce 1000 tons or more weekly, and I will admit (for my argument's sake) that the strictest economy is throughout observed, from the raising of the ore and coal, to the despatch of the finished iron; but upon all the various costs and charges which belong to the production of the iron, the interest upon a large amount of dead capital has to be brought into calculation, at such a rate as shall not only cover common interest, but also the wear and tear, and the yearly diminution in value of works in operation. I will not venture an opinion how heavily they bear upon some large works, nor can I say how much capital has been irrecoverably lost, for want, at the outset, of a clear knowledge of all the requirements of iron works, but I know that such an item does fall very heavily upon each ton of iron produced. Were it in my power to look back into the private history of many large works from their early commencement, and gradually to trace the expenditure of their capital, I should find large sums devoted to projects of which no vestige now remained; whilst the erection of the requisite machinery had cost more than double its original estimate. If such works were to be sold at a price ascertained by a fair valuation, perhaps, that which by degrees, one way or another, had cost £500,000 would be found not to be worth half that sum. If iron works are intended to pay, their projectors must bear in mind that every £1,000 sunk in the works, &c., will eventually inflict a charge per ton upon their produce; and the smaller such produce is, the heavier

EXPORTS OF IRON TO VARIOUS COUNTRIES IN THE YEARS 1856 AND 1857.

PIG IRON.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	...	..	...	...	...	...	...	...
Brazil	...	...	...	...	...	...	...	...
British North America	12,428	15,922	45,886	61,754	3,494	15,868	...	...
East Indies	...	...	...	...	...	...	...	...
Egypt	...	...	...	...	...	...	...	...
France	84,923	89,401	326,552	331,957	4,478	5,405	...	...
Hanse Towns	...	...	...	...	...	...	...	...
Holland	54,258	83,226	212,021	328,566	28,968	116,545	...	...
Prussia	39,296	67,297	151,509	254,733	28,001	103,224	...	...
Sardinia	...	...	...	...	...	...	...	...
United States	58,500	46,752	228,620	180,953	...	...	11,748	47,667
Unenumerated Countries	107,921	120,617	420,530	453,504	12,696	32,974	...	...
Total in 12 months	357,326	423,215	1,385,118	1,611,467	77,637	274,016	11,748	47,667
Deduct [Increase or] Decrease					11,748			
Total Increase [or Decrease]					65,889	226,349		
Per centage of Increase [or Decrease]					18⅓	16¼		

CASTINGS.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	15,801	7,787	170,572	108,539	...	...	8,014	62,033
Brazil	3,992	4,726	51,612	61,795	734	10,183	...	...
British North America	5,293	5,935	33,667	44,168	642	5,501	...	...
East Indies	16,162	18,421	114,211	151,096	2,259	36,885	..	...
Egypt	55	833	917	12,676	778	11,759	...	...
France	...	...	...	...	...	...	...	...
Hanse Towns	...	...	...	...	...	...	...	...
Holland	...	...	...	...	...	...	...	...
Prussia	...	...	...	...	...	...	...	...
Sardinia	1,870	279	16,354	3,829	...	...	1,591	12,625
United States	835	2,587	22,101	30,855	1,752	8,754	...	...
Unenumerated Countries	28,386	32,212	297,743	341,661	3,826	43,918	...	...
Total in 12 months	72,394	72,780	712,177	754.619	9,991	117,000	9,605	74,558
Deduct [Increase or] Decrease					9,605	74,558		
Total Increase [or Decrease]					386	42,442		
Per centage of Increase [or Decrease]					½	6		

BOLT AND ROD.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	19,485	33,247	193,799	295,179	13,762	101,380	...	...
Brazil	...	...	...	...	...	...	...	...
British North America	33,596	48,682	287,677	414,532	15,086	126,855	...	...
East Indies	116,051	114,123	1,016,247	1,016,133	...	...	1,928	114
Egypt	...	...	...	...	...	...	...	...
France	71,344	30,136	617,571	247,028	...	...	41,208	370,543
Hanse Towns	25,656	18,018	253,941	166,608	...	...	7,638	87,333
Holland	15,773	27,511	153,318	240,455	11,738	87,137	...	...
Prussia	...	...	...	...	...	...	...	...
Sardinia	15,385	18,790	131,146	156,587	3,405	25,441	...	...
United States	231,556	221,430	2,027,876	1,917,076	...	...	10,125	110,800
Unenumerated Countries	173,028	209,464	1,535,949	1,803,467	36,436	267,518	...	...
Total in 12 months	701,873	721,401	6,217,524	6,257,065	80,427	608,331	60,899	568,790
Deduct [Increase or] Decrease					60,899	568,790		
Total Increase [or Decrease]					19,528	39,541		
Per centage of Increase [or Decrease]					2¾	⅝		

SHEET, PLATE, AND SUNDRY WROUGHT IRON.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	15,422	19,570	325,419	449,817	4,148	124,398	...	...
Brazil	...	..	...	...	...	...	...	...
British North America	19,793	19,581	265,820	273,280	...	7,460	212	...
Denmark	...	...	...	...	...	...	...	...
East Indies	39,662	29,421	493,557	481,816	...	...	10,241	11,741
France	...	...	...	...	...	...	...	...
Hanse Towns	...	...	...	...	...	...	...	...
Holland	17,503	20,408	236,799	228,438	2,905	...	...	8,361
Russia	...	...	...	...	...	...	...	...
Sardinia	...	...	...	...	...	...	...	...
Spain	...	...	...	...	...	...	...	...
United States	45,714	46,497	577,262	564,631	783	...	...	12,631
Unenumerated Countries	138,165	144,735	1,821,576	1,981,416	6,570	159,840	...	...
Total in 12 months	267,259	280,212	3,720,433	3,979,398	14,406	291,698	10,453	32,733
Deduct [Increase or] Decrease					10,453	32,733		
Total Increase [or Decrease]					3,953	258,965		
Per centage of Increase [or Decrease]					1½	7		

STEAM ENGINES.

To	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. £	Decrease in 1857. £
Australia	54,411	79,786	25,375	...
Brazil	...	...	..	...
British North America	60,449	16,721	...	43,728
Denmark	4,335	19,743	15,408	...
East Indies	61,737	96,169	34,432	...
France	18,612	51,110	32,498	...
Hanse Towns	...	...	...	...
Holland	115,168	32,421	...	82,747
Russia	26,193	67,375	41,182	...
Sardinia	38,109	22,463	...	15,646
Spain	132,459	116,578	...	15,881
United States	...	...	...	...
Unenumerated Countries	307,594	559,920	252,326	...
Total in 12 months	819,067	1,062,286	391,221	158,002
Deduct [Increase or] Decrease			158,002	
Total Increase [or Decrease]			233,219	
Per centage of Increase [or Decrease]			29½	

SUNDRY MACHINERY.

To	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. £	Decrease in 1857. £
Australia	101,283	106,779	5,496	...
Brazil	...	...	...	...
British North America	...	...	...	...
Denmark	...	...	...	...
East Indies	392,591	463,709	71,118	...
France	158,249	217,045	58,796	...
Hanse Towns	168,768	184,124	15,356	...
Holland	88,308	134,035	45,727	...
Russia	238,524	531,230	292,706	...
Sardinia	...	...	...	...
Spain	141,269	125,508	...	15,761
United States	...	...	...	...
Unenumerated Countries	608,394	1,058,307	449,913	...
Total in 12 months	1,897,386	2,820,737	939,112	15,761

HARDWARE.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	4,232	5,661	408,949	489,932	1,429	80,983	...	...
Brazil	1,541	2,389	125,348	189,104	848	63,756	...	...
British North America	1,937	1,794	182,326	194,369	...	12,043	143	...
Denmark	...	...	...	...	...	...	...	...
East Indies	1,750	2,452	170,495	218,863	702	48,368	...	...
France	601	637	95,856	112,699	36	16,843	..	...
Hanse Towns	2,073	1,985	217,379	216,298	...	...	88	1,801
Holland	...	...	...	...	...	...	...	...
Russia	...	...	...	...	...	...	...	...
Sardinia	...	...	...	...	...	...	...	...
Spain	...	...	...	...	...	...	...	...
United States	8,480	7,284	1,222,419	1,031,867	...	...	1,196	190,552
Unenumerated Countries	14,124	17,048	1,324,826	1,563,195	2,924	238,369	...	...
Total in 12 months	34,738	39,250	3,747,598	4,016,327	5,939	460,362	1,427	191,633
Deduct [Increase or] Decrease					1,427	191,633		
Total Increase [or Decrease]					4,512	268,729		
Per centage of Increase [or Decrease]					13	7		

EXPORTS OF IRON TO VARIOUS COUNTRIES IN THE YEARS 1856 AND 1857.

WIRE.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	...	...	...	...	...	...	...	...
British North America	...	...	...	...	...	...	...	...
Hause Towns	..	...	...	...	...	...	..	...
United States	...	...	...	...	...	...	...	...
Unenumerated Countries	9,190	11,443	195,034	243,399	2,253	48,365	...	...
Total in 12 months	9,190	11,443	195,034	243,399	2,253	48,365		
Deduct Increase or Decrease								
Total Increase or Decrease					2,253	48,365		
Per centage of Increase or Decrease					21½	24¾		

STEEL.

To	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Australia	...	...	...	...	...	...	...	...
British North America	...	...	...	...	...	...	...	...
Hause Towns	...	...	...	...	...	...	...	...
United States	13,719	13,366	462,958	442,240	...	...	353	20,718
Unenumerated Countries	8,139	8,995	272,865	306,141	816	33,276	..	
Total in 12 months	21,858	22,321	735,823	748,381	816	33,276	353	20,718
Deduct Increase or Decrease					353	20,718		
Total Increase or Decrease					463	12,558		
Per centage of Increase or Decrease					2	1¾		

TIN PLATES.

To			Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857.	Increase in 1857. £	Decrease in 1857.	Decrease in 1857. £
Australia	...	...	27,965	36,540	..	8,575	...	...
British North America	...	...	43,776	41,161	...	...	...	2,615
Hause Towns	...	...	32,760	32,471	...	...	...	289
United States	...	...	1,020,303	961,512	...	...	...	58,791
Unenumerated Countries	...	...	283,102	429,308	...	146,206	...	...
Total in 12 months			1,407,906	1,500,992		154,781		61,695
Deduct Increase or Decrease						61,695		
Total Increase or Decrease						93,806		
Per centage of Increase or Decrease						6½		

TO DENMARK.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Steam Engines	...	...	4,335	19,743	...	15,408	...	...
Sundry Machinery	...	...	...	...	...	...	...	...
Total in 12 months			4,335	19,743		15,408	...	...
Deduct Increase or Decrease								
Total Increase or Decrease						15,408		
Per centage of Increase or Decrease						355		

TO RUSSIA.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Steam Engines	...	...	26,193	67,375	...	41,182	...	...
Sundry Machinery	...	...	238,524	531,230	...	292,706	...	...
Total in 12 months			264,717	598,605	...	333,888	...	...
Deduct Increase or Decrease								
Total Increase or Decrease						333,888		
Per centage of Increase or Decrease						126		

TO SPAIN.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856. £	Declared Value. 1857. £	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Steam Engines	...	...	132,459	116,578	...	...	...	15,881
Sundry Machinery	...	...	141,269	125,508	...	...	...	15,761
Total in 12 months			273,728	242 086	...	...	...	31,642
Deduct Increase or Decrease								
Total Increase or Decrease								31,642
Per centage of Increase or Decrease								11

EXPORTS OF IRON TO VARIOUS COUNTRIES IN THE YEARS 1856 AND 1857.

TO BRAZIL.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £	Decrease in 1857. Tons.	Decrease in 1857. £
Castings	3,992	4,726	£51,612	£61,795	743	10,183	...	...
Rails—Bar, Bolt, and Rod Iron	...	...	...	...	...	...	...	...
Steam Engines	...	...	...	...	...	...	...	...
Hardware	1,541	2,389	125,348	189,104	848	63,756	...	...
Total in 12 months	5,533	7,115	176,960	250,899	1,582	73,939	...	...
Deduct increase or decrease								
Total increase or decrease					1,582	73,939	...	...
Per Centage of increase or decrease					28½	41¾	...	...

TO EGYPT.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £.	Decrease in 1857. Tons.	Decrease in 1857. £.
Castings	55	833	£917	£12,676	778	11,759	...	...
Rails—Bar, Bolt, and Rod Iron	...	...	...	...	...	...	...	...
Steam Engines	..	...	...	...	...	...	...	...
Hardware	...	...	...	...	...	...	...	...
Total in 12 months	55	833	917	12,676	778	11,759	...	...
Deduct Increase or Decrease								
Total Increase or Decrease					778	11,759	...	...
Per Centage of Increase or Decrease					1,411	1,282	...	...

TO SARDINIA.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £.	Decrease in 1857. Tons.	Decrease in 1857. £.
Castings	1,870	279	£16,354	£3,829	...	...	1,591	12,525
Rails—Bar, Bolt, and Rod Iron	15,385	18,790	131,146	156,587	3,405	25,441	...	...
Steam Engines	...	...	38,109	22,463	...	...	...	15,646
Hardware	...	...	...	...	...	...	...	...
Total in 12 months	17,155	19,069	185,609	182,879	3,405	25,441	1,591	28,171
Deduct Increase or Decrease					1,591			25,441
Total Increase or Decrease					1,914	...	...	2,730
Per Centage of Increase or Decrease					11	..	...	1½

TO FRANCE.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £.	Decrease in 1857. Tons.	Decrease in 1857. £.
Pig Iron	84,923	89,401	326,552	333,957	4,478	5,405	...	...
Rails—Bar, Bolt, and Rod Iron	71,314	30,136	617,571	247,028	...	...	41,208	370,543
Sheet, Plate, and Sundry Wrought	...	...	...	...	...	...	...	...
Steam Engines	...	...	18,612	51,110	...	32,498	...	...
Sundry Machinery	...	...	158,249	217,045	...	58,796	...	...
Hardware	601	637	95,856	112,699	36	16,843	...	...
Total in 12 months	156,868	120,174	1,216,840	959,839	4,514	113,542	41,208	370,543
Deduct Increase or Decrease							4,514	113,542
Total Increase or Decrease					...	...	36,694	257,001
Per Centage of Increase or Decrease					...	...	23½	21

TO HOLLAND.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £.	Decrease in 1857. Tons.	Decrease in 1857. £.
Pig Iron	54,258	83,226	212,021	328,566	28,968	116,545	...	...
Rails—Bar, Bolt, and Rod Iron	15,773	27,511	153,318	240,455	11,738	87,137	...	...
Sheet, Plate, and Sundry Wrought	17,503	20,408	236,799	228,438	2,905	...	...	8,361
Steam Engines	...	...	115,168	32,421	...	...	...	82,747
Sundry Machinery	...	...	88,308	134,035	...	45,727	...	...
Hardware	...	...	...	...	...	...	...	...
Total in 12 months	87,534	131,145	885,614	963,915	43,611	249,409	...	91,108
Deduct Increase or Decrease						91,108		
Total Increase or Decrease					43,611	158,301		
Per Centage of Increase or Decrease					50	19½		

TO PRUSSIA.

	Tons. 1856.	Tons. 1857.	Declared Value. 1856.	Declared Value. 1857.	Increase in 1857. Tons.	Increase in 1857. £.	Decrease in 1857. Tons.	Decrease in 1857. £.
Pig Iron	39,296	67,297	151,509	254,733	28,001	103,224	...	...
Rails—Bar, Bolt, and Rod Iron	...	...	...	...	...	...	...	...
Sheet, Plate, and Sundry Wrought	...	...	...	...	...	...	...	...
Steam Engines	...	...	...	...	...	...	...	...
Sundry Machinery	...	...	...	...	...	...	...	...
Hardware	...	...	...	...	...	...	...	...
Total in 12 months	39,296	67,297	151,509	254,733	28,001	103,224	...	..
Deduct Increase or Decrease								
Total Increase or Decrease					28,001	103,224		
Per Centage of Increase or Decrease					73¾	67½		

EXPORTS OF IRON TO VARIOUS COUNTRIES IN THE YEARS 1856 AND 1857.

TO AUSTRALIA.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Castings	15,801	7,787	170,572	108,539	...	...	8,014	62,033
Rails—Bar, Bolt, and Rod Iron ...	19,485	33,217	193,799	295,179	13,762	101,380	...	...
Sheet, Plate, and sundry Wrought	15,422	19,570	325,419	449,817	4,148	123,498	...	...
Steam Engines	...	...	54,611	79,786	...	25,375	...	...
Sundry Machinery...	...	...	101,283	166,779	...	5,496	...	...
Tinned Plates.........	...	...	27,965	36,540	...	8,575	...	...
Hardware	4,939	5,561	408,949	489,632	1,429	80,983	...	...
Total in 12 months	54,940	66,255	1,282,398	1,566,572	19,339	346,207	8,014	62,033
Deduct Increase or Decrease					8,014	62,033		
Total Increase or Decrease					11,325	284,174		
Per centage of Increase or Decrease					$22\frac{1}{3}$	22		

TO EAST INDIES.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Castings	16,162	18,421	114,211	151,096	2,259	36,885	...	...
Rails—Bar, Bolt, and Rod Iron	116,051	114,123	1,016,247	1,016,133	...	...	1,928	114
Sheet, Plate, and sundry Wrought	39,662	29,421	493,557	481,816	...	...	10,241	11,741
Steam Engines	...	...	61,737	96,169	...	34,432	...	...
Sundry Machinery	...	...	392,591	463,709	...	71,118	...	...
Tinned Plates	...	...	...	...	...	...	...	...
Hardware	1,750	2,452	170,495	218,863	702	48,368	...	...
Total in 12 months	173,625	164,417	2,248,838	2,427,786	2,961	190,803	12,169	11,855
Deduct Increase or Decrease						11,855	2,961	
Total increase or Decrease						178,948	9,208	
Per centage of Increase or Decrease						8	$5\frac{1}{4}$	

TO HANSE TOWNS.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Castings	...	...	...	...	...	...	...	...
Rails—Bar, Bolt, and Rod Iron	25,656	18,018	253,941	166,608	...	...	7,638	87,333
Sheet, Plate, and sundry Wrought	...	...	...	...	...	...	...	...
Steam Engines	...	...	...	...	...	...	...	...
Sundry Machinery	...	...	168,768	184,124	...	15,356	...	...
Tinned Plates	...	...	32,760	32,471	...	...	...	289
Hardware	2,073	1,985	217,379	216,298	...	...	88	1,081
Total in 12 months	27,729	20,003	672,848	599,501		15,356	7,726	88,703
Deduct Increase or Decrease								15,356
Total Increase or Decrease							7,726	73,347
Per centage of Increase or Decrease							28	11

TO BRITISH NORTH AMERICA.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Pig Iron	12,428	15,922	45,886	61,754	3,494	15,868	...	...
Castings	5,293	5,935	38,667	44,168	642	5,501	...	...
Rails—Bar, Bolt, and Rod Iron ...	33,596	48,682	287,677	414,532	15,086	126,855	...	...
Plate, Sheet, and sundry Wrought	19,793	19,581	265,820	273,780	...	7,460	212	...
Steam Engines	...	...	60,449	16,721	...	...	...	43,728
Sundry Machinery..	...	...	...	...	...	...	...	...
Hardware	1,937	1,794	162,326	194,369	...	12,043	143	...
Steel.....................	...	...	...	...	...	...	...	...
Tinned Plates.........	...	...	43,776	41,161	...	...	...	2,615
Wire......................	...	...	...	...	...	...	...	...
Total in 12 months	73,047	91,914	924,601	1 045,985	19,222	167,727	355	46,343
Deduct Increase or Decrease					355	46,343		
Total Increase or Decrease					18,867	121,384		
Per centage of Increase or Decrease					$25\frac{3}{4}$	13		

TO UNITED STATES.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Pig Iron	58,500	46,752	228,620	180,953	...	...	11,748	47,667
Castings	835	2,587	22,101	30,855	1,752	8,754	...	...
Rails—Bar, Bolt, and Rod Iron	231,555	221,430	2,027,876	1,917,076	...	...	10,125	110,800
Plate, Sheet, and sundry Wrought	45,714	46,497	577,262	564,631	783	...	...	12,631
Steam Engines	...	...	...	...	...	...	...	...
Sundry Machinery	...	...	...	...	...	...	...	...
Hardware	8,680	7,284	1,222,419	1,031,867	...	...	1,196	190,552
Steel	13,719	13,366	462,958	442,240	...	...	353	20,718
Tinned Plates	...	...	1,020,303	961,512	...	...	...	58,791
Wire	...	...	...	...	...	...	...	...
Total in 12 months	358,803	337,916	5,561,569	5,129,134	2,535	8,754	23,422	661,159
Deduct Increase or Decrease					...		2,535	8,754
Total Increase or Decrease							20,887	432,405
Per centage of Increase or Decrease							$5\frac{3}{4}$	$7\frac{3}{4}$

TO UNENUMERATED COUNTRIES.

	Tons.		Declared Value.		Increase in 1857.		Decrease in 1857.	
	1856.	1857.	1856.	1857.	Tons.	£.	Tons.	£.
Pig Iron	107,921	120,617	420,530	453,504	12,696	32,976	...	...
Castings	28,386	32,212	297,743	341,661	3,826	43,918	...	...
Rails—Bar, Bolt, and Rod Iron	173,028	209,464	1,535,949	1,803,407	36,436	267,518	...	...
Plate, Sheet, and sundry Wrought	138,165	144,735	1,821,514	1,981,416	6,570	159,840	...	...
Steam Engines	...	...	307,594	559,920	...	252,326	...	...
Sundry Machinery	...	...	608,394	1,058,307	...	449,913	...	...
Hardware	14,124	17,048	1,324,826	1,563,195	2,924	238,369	...	...
Steel	8,139	8,955	272,865	306,141	816	33,276	...	...
Tinned Plates	...	...	283,102	429,308	...	146,206	...	...
Wire	9,190	11,443	195,034	243,399	2,253	48,365	...	...
Total in 12 months	478,953	544,474	7,067,613	8 740,318	65,521	1,672,705		
Deduct Increase or Decrease						...		
Total Increase or Decrease					65,521	1,672,705		
Per centage of Increase or Decrease					$23\frac{1}{2}$	$27\frac{1}{2}$		

SUMMARY OF TOTAL EXPORTS OF IRON, TO ALL COUNTRIES, IN THE YEARS 1856 AND 1857.

Description.	Tons.		Declared Value.		Equivalent in Pig Iron.		Increase in 1857.	
	1846.	1857.	1856.	1857.	1856.	1857.		
			£.	£.	Tons..	Tons.	Tons.	£.
Pig Iron	357,326	423,215	1,385,118	1,611,467	357,326	423,215	65,889	226,349
Castings	72,394	72,780	712,177	754,619	76,013	76,419	406	42,442
Rails, Bar, Bolt, & Rod Iron	701,873	721,401	6,217,524	6,257,065	935,830	961,868	26,038	39,541
Plates, Sheet, and Sundry Wrought Iron............	276,259	280,212	3,720,433	3,979,398	368,345	373,616	5,271	258,965
Steam Engines	.....	......	819,067	1,062,286	54,604	70,819	16,215	243,219
Sundry Machinery	......	......	1,897,386	2,820,737	94,869	141,036	46,167	923,351
Hardware........................	34,738	39,250	3,747,598	4,016,327	74,952	80,326	5,374	268,729
Steel..............................	21,858	22,321	735,823	748,381	32,787	33,481	694	12,558
Turned Plates..................	......	......	1,407,906	1,500,992	78,217	83,388	5,171	93,086
Wire...............................	9,190	11,433	195,034	243,399	13,785	17,164	3,379	48,365
Total in 12 Months	......	......	20,838,066	22,994,671	2,086,728	2,261,332	174,604	2,156,605
Per Centage of Increase ...							8¼ per cent.	10½ per cent.

EXPORTS OF IRON FOR THE FIRST THREE MONTHS OF THE YEAR 1858.

Description of Iron.	March 31, 1857.	March 31, 1858.	March 31, 1857. Declared Value.	March 31, 1858. Declared Value.	March 31, 1857. Equivalent in Pig Iron.	March 31, 1858. Equivalent in Pig Iron.	March 31, 1858. Increase.	March 31, 1858. Decrease.
	Tons.	Tons.	£.	£	Tons.	Tons.	Tons.	
Pig Iron	71,595	52,609	279,756	164,467	71,595	52,609	......	18,986
Castings	21,780	16,492	200,646	178,714	22,869	17,321	......	5,548
Bar, Bolt, and Rod	165,774	107,370	1,441,767	875,200	221,032	143,160	......	77,872
Wrought, Sundry	56,239	35,930	812,953	560,759	74,985	47,906	......	27,079
Wire	2,718	1,842	51,266	41,658	4,077	2,763	......	1,314
Steel..............................	5,375	2,372	186,002	91,032	8,062	3,558	......	4,504
Tinplates........................	......	......	368,243	223,682	20,515	12,427	......	8,088
Machinery	......	......	434,062	428,499	21,703	21,425	......	278
Steam-Engines	......	......	244,221	231,025	16,281	15,401	......	880
Hardware	8,948	7,168	902,866	679,267	18,057	13,585	......	4,472
			4,921,782 3,474,303	3,474,303	479,176 330,155	330,155	......	149,021
Decrease in 3 Months.........			1,447,479		149,021			
			29¼		31	Per Centage of Decrease.		

NOTE.—The decrease in the Quarter has been chiefly to the United States, viz.:—118,236 Tons out of 149,021, and 25¾ per cent, out of 31 per cent.

will this charge become. If, therefore, capital be recklessly dissipated, it may soon be discovered that the interest, and annual depreciation, will sweep away all profits, because, the number of tons of iron annually made will not bear so heavy an additional charge upon their actual prime cost of manufacture.

Much might be said upon the position of works, but the cheap transit by railway of raw material renders this less a question of importance than formerly; the economical erection of large works is a matter of very serious consideration; the means necessary to produce a required result should be well matured before they are acted upon, and applied with the greatest economy. Careful and circumspect management is imperative in every branch of this manufacture, when we bear in mind that everything which falls short of the standard of economy (by which I mean all the calculations of cost in the manufacture of the iron) is a dead loss. And, whilst I refer to the manager, let me not forget the workman. If this useful portion of our population contribute so largely to the profitable investment of capital, it deserves, and ought to have, a large share of consideration, both from the owners and managers of iron works. We must acknowledge that they perform their work with an intelligence and physical energy equalled by no other nation. Besides the common operations in iron works, a vast amount of skilled labour is continually required; these talented workmen secure to us that manufacturing pre-eminence we enjoy, and it is this union of action, this chain of circumstances, which has raised our staple manufacture to its present state of prosperity. Let, then, our labouring classes be cared for; if they give us their labour with free minds and willing hands, secure to each family a comfortable home; provide the means for a sufficient amount of education to their youth, and of offering up their united thanksgiving to their God. Whilst those exercising authority must at all times maintain their position towards the workmen, and insist upon order and regularity, I feel, because I know from experience, that a master, whilst he acts with firmness and decision, can, and will, command the respect, the unrelaxing duty, and I may also add the attachment of all those who work under his direction;

but such a master, to enable him properly to direct others, must know his business, and he must, in all his acts, make every man feel that he is able to detect the smallest neglect of duty.

When a nation has made rapid strides in any branch of manufacture, it is not surprising to find a natural as well as a laudable desire to follow in the same path. Whilst England may, at present, look round with some security upon the efforts of other countries, do not let us forget that amongst other nations, as well as our own, knowledge daily expands, and will lead them gradually and imperceptibly not only to imitate that perfection which we have attained, but also to add their own improvements. The progressive development of our mineral riches, particularly of our coal and iron, forms a formidable item in the estimate of our national wealth, it increases our importance as a manufacturing people, and strengthens our relative position with other nations, as well as in our own colonies.

Whilst we are engaged in laying down that mysterious link of intelligence with the Western hemisphere, let us not forget our own immediate requirements; we have the power, let us also have the will to bring our Eastern metropolis in direct communication with the rulers of that vast empire at home; let us hope to see her rivers, which everywhere stretch their arms throughout this land, teeming with riches and prolific vegetation, covered with light-draught steam-boats; let railroads open out the immense resources of a country which has successively enriched many European nations, and England's wealth and energy will then draw from this long neglected portion of our empire, those benefits which she ought long ere this to have enjoyed.

DISCUSSION.

Mr. Davies said he was particularly struck with the statement made in the paper that from the ordinary samples of Welsh iron, a good metal might be manufactured at a cost of 5s. per ton. All the ordinary processes that they heard of for the manufacture of cheap iron would not come up to that, and he should be glad to find that it was brought extensively into practice. He had frequently heard in that room many excellent theories propounded upon this subject, and he, for one, would be very gratified to see the results of them in practice upon a large scale, but nothing he had heard that evening gave him more pleasure than the statement with regard to the reduced cost of converting pig-iron into steel, which was known to be, at the present time, one of the most expensive processes in which iron manufacturers were engaged. With regard to the question of iron rails, he thought many railway engineers were at fault. Mr. Sanderson had spoken of so many cwts. of pig-iron being required to make a ton of iron rails, but it was to be remarked that a very large quantity of rails were made from that which could scarcely be called iron. Engineers did not always insist upon having the best article, but upon having an article according to the specification which they themselves furnished. Railway tyres were ordered to be of the best quality of iron, but when they came to rails, which he considered to be the most important element in the construction of a railway, a specification was given, based upon theory, as to how the rails should be made. The result of this was that the rails became laminated, making a renewal necessary every three or four years, and creating a liability to accident. It would be found that those lines which were the best constructed as regarded the quality of the materials employed, were the best paying lines. For proof of this, he might mention the North Eastern railway, on which the best quality of rails had been put down, and the result had been, that although the traffic on that line was extremely heavy, yet the expense of maintenance was less than on almost any other line in the kingdom. Engineers often inserted in their specifications that rails should be made "under the hammer," though it was very well known that rails could be made in this way with almost any description of iron. There was an instrument called a "squeezer," which only squeezed the cinder into the metal, without getting rid of it; the squeezer was very inferior to the Nasmyth hammer, which could be so adjusted as to give the lightest or heaviest blows, according to circumstances, and with such an instrument as that, the best rails might be produced. The question of our commerce in iron was an extremely interesting one; and he thought it should be an object with us to show to our continental neighbours that they would be more largely benefited by buying cheap iron of us than by attempting to manufacture it themselves; for where was the labourer in the neighbouring kingdom of France who did not stand in need of a cheap piece of iron? and that could be obtained from this country alone. The present enlightened ruler of France had shown a desire to benefit the people by encouraging the introduction of cheap iron, and we ought not to neglect any opportunity of impressing upon the French people that they had to pay an extra price for their spades and their ploughs and other implements of husbandry, in order to support a monopoly amongst the iron masters of their own country. If our iron trade was extended in proportion to the development of that manufacture, and if continental nations would imitate our example in buying their commodities in the cheapest market, it would enable us to make iron still cheaper, on the principle that a large demand for an article tended to reduce its cost. With regard to America, they must bear in mind that the people of that country voluntarily consented to an iron tax, in order to support certain iron manufacturers at home. They had frequently been told in that room of the vast quantities of coal and ironstone that England possessed; and he might mention one fortunate circumstance, namely, that in South Wales they had coal, and ironstone, and limestone, all of which were ingredients in the manufacture of iron, in closer proximity to each other than, probably, in any other part of the world. These facilities enabled the iron masters of South Wales to hold their own pretty well, even in the present hard times. All the iron masters of England asked for was a clear stage and no favour, and they were prepared to feed the world with iron, which was almost as important an article as bread.

Mr. Joseph Glynn remarked, that in the excellent paper now before them they had been told—not only how much had been done, and what great improvements had taken place in our iron manufactures—but it was shadowed forth that in many respects we were still deficient. It was stated that limestone contained forty per cent. of carbonic acid, and that atmospheric air contained seventy-nine per cent. of nitrogen and twenty-one of oxygen. The quantity of crude material put into the furnace to make a bar of iron was about seven tons of iron-stone, coal, and limestone, and it required three times that weight of atmospheric air to carry on the combustion necessary for the smelting of that mass of materials. It was fortunate, however, that pure air was to be had in plenty merely for the trouble of forcing it into the furnace; but large quantities of mixed gases were thrown off in a state in which they carried away a vast quantity of heat, which heat was in most cases totally wasted. There was a wide field for improvement in that respect. The relative strength of hot and cold blast iron had been touched upon in the paper. That was still a disputed point; but he thought the hot blast produced a material which, like many other things, might be advantageously employed for certain purposes; and at the same time, like high pressure steam and other strong means, it might also be used detrimentally. The hot blast might be used to smelt materials which contained a variety of compounds mingled with the iron; and they must not lose sight of the advantages which had resulted in Scotland from the use of the "black band," as pointed out by Mr. Mushet, and the great wealth that had been derived from the use of that material smelted by the hot

blast. These were points which afforded a wide field for investigation, and were well deserving the attention of ironmasters, opening up as they did a subject of extensive research both for the practical man and the chemist; and he regarded a paper such as that now before them as a great means of contributing to the advancement of this most important branch of our staple manufactures.

Mr. NEWTON, in reference to the remarks that had fallen from Mr. Glynn, as to the waste of the gases thrown off from the blast furnace, said, it had been explained by Mr. Sanderson, that means were now adopted for utilising those products, and the heat arising therefrom. That process had been carried out, to a great extent, at Alsace, where large quantities of iron were manufactured; and it was also in operation at the Ebbw-Vale Iron Works. It had now become generally known: the patent had expired some years, and it could be adopted, with no cost beyond that of the apparatus. He thought, with regard to the process described by Mr. Sanderson, in his paper, that the use of refined metal in the manufacture of iron generally must be advantageous. When this subject of the manufacture of iron and steel was before the Society, on a former occasion, Mr. Sanderson wrote a letter, in which he alluded to this process of his, and he (Mr. Newton) took the liberty of expressing a doubt as to the cost at which it was alleged that bar-iron could be converted into steel. At the same time, he was quite prepared to admit the utility of the process, provided the cost were such as would enable them to produce the material at a reasonable rate. Mr. Sanderson appeared to have taken notice of these observations, and he now stated that he could produce his refined iron at a cost of something like 18s. per ton.

Mr. SANDERSON said, that was the cost of converting bars of iron into steel: the cost of converting the pig-iron into refined iron was a different thing—that was only 5s., per ton. When the iron was made into bar it cost about 18s., to convert it into steel.

Mr. NEWTON apprehended that included waste as well as labour?

Mr. SANDERSON said there was no waste.

Mr. NEWTON remarked that the great point was to get rid of the impurities in the metal. At what cost was that done?

Mr. SANDERSON replied 5s. per ton.

Mr. NEWTON added—If that were so, he apprehended manufacturers would be very glad to employ the process. There was one point which Mr. Sanderson had not alluded to. He had not given them any statistics as to the relative strength of the refined iron as compared with the common iron; because, after all, this was a question which must be decided by figures. The only other point he would allude to, was with respect to some of those new processes of manufacturing steel which Mr. Sanderson appeared to think had not been entirely successful. He (Mr. Newton) would only say that he had seen excellent steel, both bar and sheet, made at the Mersey Iron and Steel Works, under the process described by Mr. Clay, in a paper read before the Society some few weeks since, and as far as he was able to judge, it was a process which was likely to answer well. At the time of his visit to these works, Mr. Clay was making sheet-steel which was to be employed in the construction of ships, and the testing of the plates gave very satisfactory results.

Mr. HOBBS remarked that this was not the first occasion on which he had heard the opinion expressed in that room, that America was not likely ever to become a rival to England in the manufacture of iron. The reason for that was, not that they had not in America sufficient coal, or ore, or limestone, or skilled labour, but because they had not sufficient unskilled labour there, and that he believed, and indeed he hoped, they never would have. If they took the labourer as they found him in the mining districts and transplanted him in America, he would not work underground where people could get land for 5s. an acre, and where they could build their own log cabins and be independent men. That was the reason why America could not compete with England in the manufacture of iron.

Mr. SIEMENS had listened with much pleasure to Mr. Sanderson's elaborate paper, and he had to remark only on one or two points which he thought might lead to misapprehension. Mr. Sanderson stated that 28 cwt. of pig metal produced on an average only 20 cwt. of railway bar, which, in other words, was a loss of 28·6 per cent. of iron; in the processes of puddling and re-heating, in some instances the loss might probably amount to so large a per centage, but at some works with which he (Mr. Siemens) was acquainted, the loss of iron in the puddling furnace did not exceed 12, or occasionally 15 per cent., and a very superior quality of iron was produced without the intermediate process of refining being resorted to. In the course of the last twelve months he (Mr. Siemens) had been engaged upon experiments in the manufacture of iron and steel, and his observations went to prove that the loss of iron sustained in the puddling and re-heating furnaces must be attributed chiefly to the oxidizing action of the flame, which in striking against the iron converted it into slag; by the process which he had adopted (and which had been alluded to lately at this Society, on the occasion of Mr. Clay's paper), he had practically succeeded in reducing the loss sustained in the puddling of crude pig iron to 5 per cent. only, besides which he had obtained other important results, which he expected to bring shortly before the public, but which he would not enlarge upon on the present occasion. He agreed with Mr. Sanderson that not much advantage could be obtained by the use of many of the new plans of converting iron into steel which had of late been proposed, because the actual process of conversion constituted but a very small proportion in the cost of cast steel. The chief expense was incurred in melting the converted steel, the trade price for which was £10 per ton; and improvements should, he thought, chiefly be directed to this point; for machinery purposes the puddled steel by Riepe's process would probably be extensively used, because it was the only known method of producing steel in large masses without necessitating the process of melting.

Mr. HOWELL had listened with great interest to the description given in the paper of the plan of combining iron and steel so as to secure the greater resisting body of the latter in connection with the tenacious quality of the former. He produced to the meeting a specimen of his homogeneous metal, which, he said, was perfectly malleable and possessed all the strength of fused metal, but was free from lamination, combining perfect ductility with the greatest tensile strength. This was a malleable iron, fused in pots and melted in masses sufficiently large for the manufacture of blocks and sheets from one ton to ten tons each in weight, and these were in all respects as sound and as regular as the specimen he now exhibited. The tensile strength of this metal was to be depended upon up to 50 tons per square inch, and when punched there was no liability to shatter. It was in fact cast steel, but without its brittleness. It was pure iron as nearly as it could be made, means being employed to free it from the impurities which were known to exist in bar iron. Mr. Howell mentioned several of the uses to which this homogeneous metal had been applied; amongst others, for multitubular boilers, coupling chains, &c. The little steam-vessel taken out with the expedition of Dr. Livingstone was constructed of this material, the plates being only one-tenth of an inch in thickness, and these were found to be stronger than the ordinary one-eighth plates used in ship building. In reply to an inquiry, Mr. Howell added that the cost of this metal was £50 per ton, but from so much less weight being necessary, the expense was not much greater than that of the ordinary plates.

Mr. ANDERSON expressed his obligations to Mr. Sanderson for his valuable paper, and would refer to one or to points in which he felt an interest. One was the comparative merits of hot and cold blast iron. On the

point of strength, he believed it had been proved that both descriptions were pretty nearly equal, and therefore he thought the question did not so much depend upon the nature of the blast as upon the quality of the ore and fuel. Mr. Sanderson had stated that the strength of iron was in proportion to its freedom from earthy matters, from which it would be inferred that he meant that iron of the greatest specific gravity possessed the greatest tenacity. The experiments which had been made did not bear out this view. Reference had been made to the probability of making effective ordnance with wrought iron. Although one splendid specimen of manufacture of that description had been made at the Mersey works, under Mr. Clay, yet he did not think much was to be said as to the likelihood of wrought iron ordnance being employed to any extent. An immense effort had been made to manufacture wrought-iron plates of great thickness, for the purpose of floating batteries, so as to render them shot and shell proof; but, although plates had been turned out 8 or 9 inches thick, yet they failed to afford effectual resistance to these missiles. He thought they might look with some hope to the metal introduced by Mr. Howell as affording a valuable material for ordnance; or to some combination of pure iron with carbon, so as to get a material that could be cast in a mass suitable for cannon. Mr. Anderson expressed a high opinion of the value of Mr. Howell's homogeneous metal, for machinery that was intended for exportation to long distances, and where a large amount of wear and tear was expected. This, he said, had been exemplified in the case of some boilers sent to Russia. He begged to express his cordial concurrence with the concluding remarks of the paper as to the interest which employers ought to feel in the social condition of those in their service; and he believed that any measures in that direction benefited the employer and the employed.

Mr. Pearsall thought Mr. Sanderson had remarked upon the utilisation of the heat from the blast furnaces in a disparaging tone, yet science had fully proved, and practice had shown, that 80 per cent. of the heat was not employed in the conversion of the iron. It had been stated that at the Ebbw Vale works plans for rendering this surplus heat available were in constant operation. Why, then, were they not more generally adopted? It was true that there were circumstances which threw difficulties in the way. He himself had witnessed a fearful explosion, which had resulted from an attempt to carry out this system in large ironworks, and it was not surprising that this had excited considerable prejudice, though, by judicious management, such accidents might no doubt be avoided.

Mr. Winkworth rose to ask, whether "iron and steel united in a bloom, and subsequently rolled to a sheet," and otherwise prepared for the purpose, as explained in the paper, had ever been introduced in ship-building, tubular bridges, or in the construction of railways. If, from the superior quality of the material so prepared, the quantity required for a given purpose was less than that of the article generally used, the higher price of the materials might be thus neutralized. He had also to congratulate Mr. Sanderson on the clear economical views with which he had closed his very interesting paper. It was surprising that a country, so intelligent generally as France, should still adhere to a policy so suicidal as that of protection—falsely so called. It was well known that the Emperor was friendly to freedom of commercial intercourse, and his hands would be largely strengthened, if, instead of criticising modes of government, with which the people of France only were concerned, we addressed ourselves to the propagation, especially amongst the workpeople, of those principles of international mercantile policy, which would afford, in their development, the largest material comfort.

Mr. Hobbs remarked in reference to the subject of free trade, that he had recently imported machinery from the United States into England, upon which he had had to pay a duty of 10 per cent.

Mr. Davies added, in reply to the remarks of Mr. Pearsall, that in South Wales many establishments would be found where the utilisation of the gases from the furnace was carried out. In many works they would not see such a thing as a fire under the boiler, the steam being generated by the gas utilised from the blast furnaces.

The Chairman, in proposing a vote of thanks to Mr. Sanderson for his paper, said the interest and value of the paper had been increased by the discussion to which it had given rise, for he thought they would agree that this had been of an interesting and useful character. He could not allow the proceedings to close without briefly alluding to the enormous growth of this great interest in this country. He had no doubt all who heard him were aware that up to the close of the last century England imported rather than exported iron and most other materials, and yet they had heard that during the last year the exports of manufactured iron amounted to the enormous sum of twenty-two millions sterling, an amount second only to the gigantic cotton exports; and when they remembered that this had all been brought about within the short period of half a century, they felt wonder and amazement at the progress of the country; and they could only hope that if these gigantic interests were conducted with a due regard to the well-being of the great masses of the people, no evil consequences would result. It was marvellous to trace not simply the gigantic growth of the iron trade, but also to note the changes which, from time to time had taken place in the seat of that manufacture. It was a fact, known to many present, that the iron railing around St. Paul's Cathedral was manufactured within 25 miles of London, on the confines of Kent and Sussex; and that iron formed, for two or three generations, the staple manufacture of those counties. It was a curious fact, to which their attention had been directed by Mr. Davies, that those materials which were most suited to be used together, were frequently found in close proximity to each other. The ironstone, the coal, and the limestone, were all found at the same spot. With reference to the methods adopted in the manufacture of iron, he might remark that it was not until the seventeenth century that coal was used in this country to any great extent in the melting of iron ore, and it was only in the beginning of the last century that it came to be extensively used for that purpose in the iron works of Shropshire. The great value of the paper consisted, he thought, in its having directed their attention to the application of science to the iron trade, which seemed to be the only means whereby we could maintain the supremacy we had obtained over every other country in the production and manufacture of iron; and in the commercial struggle that took place between different nations, it was all important that we should take advantage of the appliances we possessed, and avail ourselves of those considerations to which Mr. Sanderson and other writers on this subject had directed attention.

A vote of thanks was then passed to Mr. Sanderson.

Mr. Sanderson, in reply, said, Mr. Davies had referred to the refined metal, and remarked that if it could be produced for five shillings per ton with so small a waste in the puddling furnace, it would be a great advantage to the trade. He (Mr. Sanderson) would give the particulars of the cost of the manufacture, showing that its cost would not, where the metal was drawn from the blast furnace, exceed five shillings per ton. The fluid metal was drawn from the blast furnace into the refinery, which was simply a receptacle heated not higher than that of the ordinary puddling furnace. Any reagent which on its decomposition gave out oxygen, was added, which, combining with the carbon eliminated from the iron, formed carbonic oxide. This immediately reduced all the metalloids and unreduced matter, entirely liberating all deleterious matter contained in the iron, thereby producing a highly decarbonized,

clean, crystallized metal. He observed that, when this metal, produced at so low a cost, was used in the puddling furnace, malleable iron was turned out, of a very superior quality and with an extremely small waste, thereby effecting a considerable economy to the iron maker, and raising the standard quality of his finished materials. Mr. Davies had observed that, owing to the orders which engineers give for rails, the makers were compelled to manufacture them of an extremely low quality, adding, that they were not iron, but a miscellaneous compound. In this Mr. Sanderson fully agreed, and that squeezers were the worst things which could be used in a work where quality was looked for. He quite agreed in the advocacy of using better rails, and thought it would be to the advantage of other companies besides the North Eastern to lay down a superior quality of rails, which, although expensive at first, were economical in the end. With regard to the objection which had been raised to the utilization of the gases, he stated that danger might arise from want of proper attention to the apparatus, thereby subjecting the gases to explosion, just as much as a steam-boiler would explode, if allowed to become dry. With reference to Mr. Howell's remarks, he (Mr. Sanderson) fully concurred in the excellence of that gentleman's metal, and compared it with his (Mr. Sanderson's) metal, which was a compound of iron and steel, the latter being so much cheaper an article that it could be made useful for many engineering purposes for which Mr. Howell's metal would be too expensive. Mr. Sanderson said that there were still observations (Mr. Siemens', Mr. Winkworth's, Mr. Hobbs', and others) to which he should have liked to reply, but the lateness of the hour prevented him from so doing, and he concluded by thanking the meeting for the attention which they had given to his paper.

The Secretary announced that on Wednesday evening next, the 12th inst, a Paper by Professor John Wilson, on "Canada: its Productions and Resources," would be read.

The following letter has been received by the Secretary since the meeting:—

Sir,—Mr. Sanderson, in his paper, has brought forward a proposition for the employment of a light combined steel and iron rail, which is of great importance if it can be carried into effect. Up to this time the progress of railways in India has been withheld by the Indian authorities, on the ground that the amount of shipping available for the cheap freight of rails is only sufficient to allow of the prosecution of the main lines of railway without causing a very great rise in freights, and thereby in the cost of the railways. On this ground sanction is refused to many valuable trunk and branch lines, the prosecution of which would be of the greatest value to India. If, therefore, a rail could be laid down of equal strength, but of half the weight, the consequence will be that the present amount of freight to India will be adequate for the supply of rails for double the length of line now in process of execution.

I am, &c., HYDE CLARKE.

Northern Bengal Railway, 42, Basinghall-street,
6th May, 1858.

SOUTH KENSINGTON MUSEUM.

During the week ending 1st May, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,591; on Monday and Tuesday (free evenings), 4,353. On the three Students' days (admission to the public 6d.), 1,199; one Students' evening, Wednesday, 173. Total, 10,316.

Proceedings of Institutions.

Bedford.—The twelfth annual meeting of the Literary and Scientific Institution was recently held in the reading-room, William Blower, Esq., vice-president, in the chair, who, after a brief introductory speech, called on Mr. Coombs, the hon. secretary, to read the report. The treasurer's account showed that, during the past year, the income had amounted to £86 10s. 7d.; the expenditure, for the same period, to £83 12s. 5d.; leaving a balance in the treasurer's hands of £2 18s. 2d. Notwithstanding that several other Institutions with similar aims and objects have been formed, the committee report considerable additions to the library, which now contains upwards of 2,000 well-selected volumes of the best writings in the various departments of science and general literature. Lectures have been delivered by Dr. Letheby (in continuation of his former lecture on "Chemical Magic,") and by George Dawson, Esq., M.A., on "The Origin, Character, and Doings of the Anglo-Saxons." Communications have been received from the Council of the Society of Arts, in reference to the Examinations for the Prizes and Certificates of the Society, and it has been suggested to the committee that a Local Board of Examiners be appointed in Bedford to act for the district of which it is the centre. The best attention of the committee will be given to this subject, and the fullest information thereon communicated in due course to the members. The vice-presidents, treasurers, secretary, librarian, auditors, and the four retiring members of the committee, were unanimously re-elected. The formation of a Local Board of Examiners for conducting the "previous Examination" of the Society of Arts for its Prizes and Certificates, as referred to in the report, was considered. A discussion ensued on the merits of the proposed Examinations, Prizes, and Certificates, and of the value of the Institution's connection with the Society of Arts, when it was resolved—"That a Local Board of Examiners be formed in accordance with the plan of the Society of Arts."

Birmingham.—A valuable collection of recent shells, British and foreign, has been presented to the Midland Institute, by Mrs. Taylor, late of Moseley Hall. They are well arranged and in excellent condition, and will form an important addition to the existing collection.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Geographical, 8½. I. Mr. James S. Wilson, "Notes on his Journey in North-west Australia." (Communicated by Sir Roderick Murchison.) II. Dr. H. Barth, "General Historical View of the State of Human Society in Northern Central Africa."

Tues. ......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Syro-Egyptian, 7½. Mr. Sharpe, "On the Gnostic Gems and Opinions of the second century of our Era."
Civil Engineers, 8. Mr. A. Giles, M. Inst. C.E., "On the Construction of the Southampton Docks."
Med. and Chirurg., 8½.
Zoological, 9.

Wed. ......Literary Fund, 3.
Society of Arts, 8. Prof. John Wilson, "On Canada: its Productions and Resources."
Geological, 8. I. Mr. G. Poulett Scrope, "On Lamination and Cleavage, caused by the Mutual Friction of the Particles of Rocks while in Irregular Motion." II. Prof. Harkness, "On Jointings, and on the Dolomites of Cork."
Graphic, 8.
Archæological Asso., 8.

Thurs. ...Antiquaries, 8.

Fri. ....United Service Inst., 3. Major Griffiths, "On Field Fortification."
Royal Inst., 8½. Mr. Henry Bradbury, "On Printing: its Dawn, Day, and Destiny."

Sat. ....Asiatic, 2. Anniversary.
Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 30, 1858.]

Dated 21st December, 1857.

3126. J. H. Nosworthy, London—An improved apparatus for exhibiting cards, bills, and other like advertisements.

Dated 6th February, 1858.

220. L. F. Candelot, 16, Rue St. Quentin, Paris—Divers anti-nitrous cements, also applicable to rendering damp surfaces impervious, and to flagging and similar purposes.

Dated 9th February, 1828.

241. G. Pringle, Prestonpans, N.B.—Imp. in machinery or apparatus for propelling ships or vessels.

Dated 9th March, 1858.

476. H. Deacon, Widnes, Lancashire—Imp. in purifying alkaline lees.

Dated 10th March, 1858.

486. J. F. Gee, Wrexham—Imp. in the joining of earthenware pipes for drains, sewers, and telegram wire conductors, also suitable for the conveyance of liquids, gas, and steam under pressure, when jointed.

Dated 11th March, 1858.

495. F. E. D. Hast, Aldermanbury—An improved mode of manufacturing stearine. (A com.)

Dated 23rd March, 1858.

608. E. Peters, Grimsby—Imp. in burning bricks and other articles, made of brick earth and clay. (A com.)

Dated 26th March, 1858.

644. J. J. T. Schlœsing, 22, Rue d'Austerlitz, and E. Rolland, 21, Rue de Bellechasse, Paris—Imp. in the manufacture of carbonates of soda.

Dated 27th March, 1858.

656. F. Bousfield, 20, Hereford-terrace, De Beauvoir-road, Kingsland—Imp. in apparatus to facilitate the production of duplicate writings.

Dated 7th April, 1858.

740. E. P. Sibille, 11, Conduit-street, Regent-street—A new apparatus for warming or cooling atmospheric air, water, and all liquids of a similar density to it, warming them to the degree of heat necessary for their transformation into steam.

Dated 9th April, 1858.

762. T. Greenwood and J. Batley, Leeds—Imp. in machinery for heckling flax and other fibrous materials.

764. R. McCafferty, Lancaster, U.S.—Preventing incrustation in steam boilers.

766. G. Smith, 21, Wichampton-street—Imp. in the manufacture of close stools, night commodes, and water closets.

770. H. Bauerrichter and C. G. Gottgetreu, Charterhouse-square—Imp. in printing gold, silver, bronze, and other metal, on glass.

Dated 10th April, 1858.

772. A. Lees, Soho Iron Works, Oldham, and D. Schofield, Oldham—Imp. in the construction of carriages for certain machines used in spinning and doubling.

774. A. Neumann, London—An improved strop for sharpening razors, knives, or other edged instruments.

778. F. A. Lecornu, Paris—Imp. in drawing and levelling instruments.

780. J. Pouncy, High West-street, Dorchester—Imp. in the production of photographic pictures.

782. W. Rowett, Netherfield-road, Liverpool—Imp. in the construction of electric telegraph cables or ropes.

784. J. Rae, Blackwall—Imp. in the construction of iron ships.

Dated 12th April, 1858.

789. T. Kay, Oxenhope, near Keighley, Yorkshire—An improved method of producing or obtaining heat suitable for the singeing of yarns and textile fabrics, which heat is also applicable to other heating purposes.

791. P. Ratel, Paris—A new or improved machine for depositing grain and manure.

Dated 13th April, 1858.

793. T. Spiller, 5, Red Lion-square—Exhibiting slides in the stereoscope, and preserving them from injury, to enable each slide to be conveyed to the point of view, and then after use deposit them each in its place in the box, without handling or exposing the slides to the chance of being soiled, keeping them always under cover in safety; a box 18 in. by 8 in. square will hold and exhibit near 1000 slides.

795. T. T. Jopling, Dunning-street, Bishopwearmouth—Imp. in waterclosets.

797. P. Schafer and F. Schafer, Brewer street—Imp. in fastenings for travelling bags, portmanteaus, and other like articles.

799. T. B. Ayshford, 1, Britannia-road, Walham-green, Fulham—Certain imp. in the construction of carriages called omnibuses.

Dated 14th April, 1858.

801. R. Armstrong, North Woolwich, and J. Galloway, Manchester—Imp. in apparatus and furnaces for heating, welding, or melting metals, parts of which improvements are applicable to other furnaces.

803. W. C. Holmes and W. Hollingshead, Huddersfield—Imp. in the manufacture of metal castings.

805. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in voltaic batteries. (A com.)

807. T. Osborne and R. A. Bell, Derby—An apparatus for suddenly detaching railway carriages or waggons.

809. C. Mather, Salford Iron Works, Salford, and H. Charlton, Blackfriars-street, Manchester—Imp. in apparatus for drying cotton, linen, wool, yarn, seed, and other articles.

811. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in sawing machines. (A com.)

813. A. F. Newton, 66, Chancery-lane—Imp. in rotary pumps. (A com.)

Dated 15th April, 1858.

815. F. Preston and W. McGregor, Manchester—Imp. in machinery for forging and cutting files.

817. L. Cowell, Adelphi—An instrument or nippers for cutting the wired, corded, or like fastenings of corked bottles.

819. W. Spence, 50, Chancery-lane—Imp. in the pedestals and journal boxes of railway carriages. (A com.)

821. J. Harris, Woodside, and T. Summerson, Haughton-le-Skerne, near Darlington—An imp. in railway chairs.

Dated 16th April, 1858.

823. J. Boot, Manchester—Imp. in machinery or apparatus for making labels.

825. P. Brotherhood, Chippenham—Imp. in the construction of locomotive and other steam boilers.

827. G. Walker, Edgbaston, Warwickshire—An improved union apparatus for cleaning and polishing knives and forks, and boots and shoes, and which said apparatus is also applicable for sharpening knives and sharpening or cleaning other articles.

829. A. P. Price, Margate—Imp. in obtaining cadmium, and certain compounds thereof.

831. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in preparing printing surfaces. (A com.)

Dated 17th April, 1858.

833. E. F. Sans, Epernay (Marne), France—Apparatus serving to mesure upon a large scale the smallest pressions of any fluid matters.

835. A. A. Lutereau, Paris—The purpose, by machinery, to polish wholly or partly leather paper hanging, and all other febril stuff, that is to say, that a piece can be polished in several parts, having spaces unpolished.

837. D. Chalmers and J. T. Swallow, Manchester—Imp. in looms.

839. J. R. Chirm, junr., Birmingham—A new or improved chimney pot or top.

845. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in sewing machines. (A com.)

847. W. Latham, Russell-court, Drury-lane—Imp. in the manufacture of hats and caps.

Dated 19th April, 1858.

849. M. B. Westhead and H. Baines, Manchester—Certain imp. in machinery or apparatus for the prevention of accidents, applicable to hoisting and other lifting machines employed in connection with railways or other places where heavy bodies require to be moved from one level to another.

851. W. H. Ridgway, East View-place, Hanley, Staffordshire—Improved apparatus for opening the covers of jugs.

853. J. Howorth, Farnworth—Improved apparatus to facilitate the discharge of smoke and prevent its return, which said apparatus is also applicable for the ventilation of buildings.

855. M. Henry, 77, Fleet-street—Imp. in the manufacture of candles, and in preparing materials for the same, and in apparatus employed therein. (A com.)

857. E. K. Calver, Sunderland—Imp. in the formation of harbours of refuge, which improvements are also applicable as a wave screen in other situations.

859. W. Clark, 53, Chancery-lane—A new instrument for taking the altitude of the sun, to be termed the "Helypsometer." (A com.)

WEEKLY LIST OF PATENTS SEALED.

30th April.

2758. W. Shields.
2760. J. Davy and W. Bentley.
2764. M. Stodart.
2784. J. Apperly & W. Clissold.
2788. J. Mallison, junr.
2793. R. Wappenstein.
2796. J. Seithen.
2805. J. Miller.
2906. G. R. and D. C. Simpson.
2810. H. Beinhauer.
2814. H. R. Palmer.
2817. G. Canouil.
2824. J. Adams.
2834. W. J. Elwin.
2844. H. and S. Thompson.
2868. M. Henry.
2908. D. Melvin.
3045. C. Westendarp, junr.
3196. P. W. Barlow.
122. W. Weild.
437. W. Thomson.

4th May.

2816. R. K. Aitchison.
2821. H. Baines.
2822. J. Fordred.
2842. J. Harrington.
2848. I. Taylor.
2866. W. Picking.
2275. G. J. Bensen.
2977. C. Goodyear.
3098. J. J. Davis.
3200. J. Long.
18. G. E. Dering.
135. G. E. Dering.
351. W. McLennan.
416. W. H. Sleeboom.
507. L. F. Corbelli.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

April 26th.

1133. F. W. Mowbray.

April 27th.

962. W. E. Carrett.
963. J. Marsh.
970. P. Dépierre.

April 28th.

984. F. W. Harrold.
998. J. Lacassagne & R. Thiers.

April 29th.

975. W. Hartley.
986. H. Lee, Junr., & J. Gilbert.

April 30th.

969. H. Francis.
979. W. Banks, H. Hampson, and J. Banks.

May 1st.

988. M. A. C. Mellier.

Journal of the Society of Arts.

FRIDAY, MAY 14, 1858.

CONVERSAZIONE.

The second Conversazione of the present session was held at the South Kensington Museum, on Saturday evening, the 8th inst.

The following divisions of the Museum were open on this occasion:—

1. The Sheepshanks Gallery of Pictures.
2. The Sculpture Gallery.
3. The Architectural Museum.
4. The Animal Produce Collections.
5. The Ornamental Art Collections.
6. The Structure and Building Materials Collections.
7. The Educational Collections.
8. The Collection of Patented Inventions (by permission of the Commissioners of Patents).
9. The Photographic Society's Exhibition (by permission of the Council of the Photographic Society).
10. The Art Training Schools.

The following objects were exhibited to the public for the first time:—

1. A Model, showing the Campaign before Sebastopol, executed by Col. Hamilton, C.B., Grenadier Guards, at the suggestion of his Royal Highness the Prince Consort, for the United Service Institution.
2. Statue of Venus, by J. Gibson, R.A., and the picture of the "Duchess of Burgundy distributing Alms," by Leys (the celebrated Belgian artist), kindly sent by Matthew Uzielli, Esq., a member of the Society.

The guests were received on entering by the Council of the Society.

The band of the 1st Life Guards attended.

The number of members and their friends present amounted to 2,280.

The Council desire to express the thanks of the Society to "A Friend of the Society," who, without stating his name, has kindly defrayed the expenses of the attendance of the Band of the 1st Life Guards at the Conversazione on Saturday last.

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty-four Local Boards have been formed. Returns of the Candidates who have passed the Previous Examination have been received, as follows:—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	29
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	18
Halifax, No. 1.	15
Salisbury	1
Liverpool	35
Lockwood	1
Halifax (Working Men's College), No. 2.	21
York	7
Berkhampstead	19
Bristol	11
London Domestic Mission	1
Royal Polytechnic Institution	28
Birmingham, No. 1, (Messrs. Chance's Reading Room)	2
Sheerness	1
Sheffield (People's College), No. 1.	15
Sheffield (Mechanics' Institution), No. 2	3
Blackburn	5
Crosby Hall (London) Evening Classes	19
Windsor and Eton	10
Greenwich	1

The total number of Candidates who have been examined by the Local Boards, is 1,098.

EXAMINATION PRIZE FUND FOR 1858.

The following is a list of Donations up to the present date:—

	£	s.
T. D. Acland, Member of Council	£ 5	5
The Rt. Hon. C. B. Adderley, M.P.	5	0
John Ames	5	5
J. G. Appold, F.R.S., Auditor	10	10
John Ball	5	5
T. H. Bastard	5	0
Messrs. Chance, Brothers	10	10
R. L. Chance	5	5
Harry Chester, Vice-Pres.	10	10
J. P. Clarke	1	1
G. Clowes	10	10
Henry Cole, C.B., Vice-Pres.	1	0
H. D. Cunningham, R.N.	1	1
C. Wentworth Dilke, Vice-Pres. Chairman of Council (third donation)	10	10
Thomas Dixon	1	1
Lieut.-Col. F. Eardley Wilmot, R.A.	5	0
Viscount Ebrington, M.P.	5	0
Lord Ebury	5	0
J. Griffith Frith, Member of Council	5	5
J. W. Gilbart, F.R.S., Treasurer (second donation)	10	10
F. Seymour Haden (annual)	2	2
William Hawksworth	1	1
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
The Marquis of Lansdowne, Vice-Pres.	20	0
George Lowe, F.R.S.	1	1
The Master of the Mint, Member of Council (second donation)	10	10
George Moffatt, M.P., Vice-Pres.	10	10
Lieut.-General Sir Charles Pasley, K.C.B.	5	0
Sir Thomas Phillips, Member of Council	5	5
William T. Radford	1	1
Charles Ratcliff, Hon. Local Sec. (annual)	10	10
Joseph Skey, M.D.	1	0
William Tooke, F.R.S., Vice-Pres.	10	10
Arthur Trevelyan	1	0
T. Twining, jun., Vice-Pres.	10	10
Dr. J. Forbes Watson	1	1
G. F. Wilson, F.R.S., Member of Council (third donation)	10	10

EXAMINATIONS.—PRIZES FOR 1858.

The following Prizes are offered to the Candidates, viz.:—

One First Prize of £5, and one Second Prize of £3 in each of the 26 subdivisions of the subjects of Examination.

No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

The Prizes will be given in money or in books, at the option of the Candidate.

The following Prizes are offered to the Local Boards, viz.:—

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than ten) bear the largest proportion to its whole number of Candidates. —One Prize of £10.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than eight) bear the largest proportion to its whole number of Candidates. —One Prize of £8.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than six) bear the largest proportion to its whole number of Candidates. —One Prize of £6.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than four) bear the largest proportion to its whole number of Candidates. —One Prize of £4.

No Local Board can receive more than one of these Prizes.

These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best, for the promotion of the objects for which it was instituted.

EXAMINATIONS.

The following Letter of Instructions has been issued to the Local Boards:—

Society of Arts, John-street, Adelphi, London, W.C.
12th May, 1858.

Sir,—I am directed by the Council of the Society of Arts to inform you that the papers for the ensuing Examination of Candidates for the Society's Certificates will be forwarded by post, on Friday, the 21st of May, in a parcel addressed to you at ________________

You will have the goodness to let me know *by telegraph* on Saturday, the 22nd, in time for the despatch of duplicate papers by that evening's post, if the parcel is not duly delivered to you in the morning of that day.

The papers in each subject will reach you in a separate envelope, the seal of which is to be broken, in the presence of the assembled Candidates, at the commencement of the time appointed for that subject in the Time-table. This direction, as well as the *order* and *hours* of Examination laid down in the Time-table, must be strictly observed. It is absolutely necessary, for the proper working and ultimate success of these Examinations, that there should not be the very least suspicion as to the perfect fairness and equality with which they are conducted at all the different centres; and such suspicions can only be obviated by the *simultaneous* employment of the *same* set of papers at each centre. On this, and on the firmness and fidelity with which the members of the Local Boards discharge the simple, though somewhat onerous, duties required of them to prevent the possibility of any dishonest dealing on the part of the Candidates while under examination, the whole success of the present scheme depends.

I am, therefore, to invite your most careful attention to the "Advice to Candidates," which you will find printed at the foot of the enclosed copies of the Time-table, and to the terms of the accompanying Declaration, one of which forms will have to be filled up and returned to me, after it has been signed by at least two members of the Local Board, at the end of each meeting of the Candidates. To provide for this it will be necessary that you should immediately make arrangements with your colleagues on the Local Board, to secure the attendance of a sufficient number of them in rotation at the different periods of the Examination. The attention of your Candidates should be drawn to the Time-table now sent to you, and copies of it should be suspended in the Examination Room.

It will further be necessary that the Local Board should provide writing paper, of foolscap size, scribbling-paper for rough drafts, and blotting-paper for the use of the Candidates, who should be desired to bring their own pens and a small inkstand to the examination room, but nothing else. They should be required, on entering the examination room, to give up all books, papers, memoranda, writing-books, or loose blotting-paper, which they may have brought with them, under the penalty of immediate exclusion from the Examination if any such articles should thereafter be found in their possession. After such notice, the plea of accident or forgetfulness cannot be admitted.

The only exception to this regulation is in the case of the Candidates who take the exercises in Mechanical Drawing, and who should be allowed to bring with them a case of Mathematical Instruments.

Stationery should be supplied to each Candidate, at the rate of three sheets of foolscap, and one of scribbling-paper, for every Paper which he works, together with one sheet of blotting-paper, which should serve for the whole of the Examination. Ruled paper will be forwarded for the use of the Candidates who are to be examined in Book-keeping.

The Time-table has been drawn up to meet the general convenience of the whole number of Candidates who will meet at the different centres. If any one, among those who are examined under your superintendence, wishes to work *two* Papers which are fixed for *the same* hour, he should be strongly recommended to confine himself to *one* of them; and to bear in mind that, while one high certificate is of more value than two low ones, he will have an opportunity, next year, of being examined in the subject which he omits on the present occasion.

The Candidates should sit, in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well, when two or more papers are worked at the same time, to arrange alternately the Candidates who take different subjects.

Three hours only are allowed for each paper, except in the case of the exercises in Drawing, for which four hours may be taken.

All writing must cease at the end of the three hours, *to a moment;* and, if there is no clock in the room, it may be well to give notice to the Candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The Candidates should leave their answers at their seats (with the Examination papers attached to them), after having carefully filed them all together in order through the upper left-hand corner. A supply of green silk twist and some large needles should be procured for this purpose.

The papers should then be collected—those on each subject separately—and arranged in the order of the Candidates' numbers. After a separate Declaration has been filled up and signed, in reference to the papers on each subject, it should be tied up with them; and the

whole set, or sets, worked each day should be forwarded on the following morning, either by post (if the numbers are small), or by railway, in *one* parcel addressed to me at this office, with an entry on the cover stating the number and subjects of the papers which it contains. The Council would also be glad if you could conveniently transmit, by the post of the same day on which each parcel is sent off, a separate letter, to announce the despatch of such parcel, and mentioning, (1) The number of papers in each subject which it contains, and (2) Whether it has been forwarded by post or rail.

The Council regret to have to saddle you with the observance of so many minute directions, but, as it is quite impossible, in the multiplicity of particulars which a simultaneous Examination, on the scale of that now about to be held, involves, to rectify any serious mistake or omission, the responsibility of every one engaged, whether in arranging or carrying out the details, becomes great in proportion.

I am, Sir,
Your obedient Servant,
P. LE NEVE FOSTER,
SECRETARY.

TIME TABLE.

The Examinations will be held on the 24th, 25th, 26th, 27th, 28th, and 29th of May.

The hours of Examination will be from nine in the morning to noon; from two to five in the afternoon, and from six to nine in the evening.*

No Candidates will be admitted after the Examinations shall have commenced.

	9 o'clock to 12 o'clock.	2 o'clock to 5 o'clock.	6 o'clock to 9 o'clock.
Whit-Monday, May 24.		Algebra. Magnetism, Electricity and Heat.	Arithmetic.
Whit-Tuesday, May 25.	English History. Navigation and Nautical Astronomy. Practical Mechanics.	Geometry. Physiology.	Book-keeping. Trigonometry. Latin and Roman History.
Wednesday, May 26.	Free hand Drawing. (From 9 o'clock to 1 o'clock.)		Mechanical Drawing. (From 5 o'clock to 9 o'clock.)
Thursday, May 27.		German. Conic Sections. Agriculture.	French. Political and Social Economy. Chemistry. Mensuration.
Friday, May 28.			Descriptive Geography. Botany. Statics, Dynamics, & Hydrostatics.
Saturday, May 29.			English Literature. Physical Geography, including Geology. Astronomy.

ADVICE TO CANDIDATES.

1. Read over the Time-table carefully, and note the hours appointed for the subjects in which you wish to be examined. Be at your seat in the Examination Room *five minutes before the hour appointed* for each Paper which you are to work.

2. When a Paper is given to you, *first* look at the instructions printed at the head of it, and *then* read the questions carefully over, marking those which you think you can answer best. Do them first, and if any time remains, you may try some of the others, but do not exceed the number of questions appointed to be answered. Remember that a few accurate and sensible answers will gain a higher number of marks than a great number of indifferent attempts.

3. No Candidate will be allowed to resume the working of a Paper after he has once left the room in the course of the time appointed for that Paper.

4. If a Candidate has any question to ask, or wants anything in the course of the Examination, he should not leave his place; but *should stand up and call out his number*, when some one will attend to him.

5. As soon as notice is given (10 minutes before the end of the time) finish your Papers, see that they are numbered rightly, and in their proper order, and leave them UNFOLDED at your seat.

CAUTION.

6. No Candidate may speak to another Candidate, on any pretence whatever, under pain of immediate expulsion.

7. Any Candidate detected in taking unfair advantages, such as referring to any Book, or Written Paper, or in seeking assistance from another, will be subject to the same penalty.

8. Whoever gives assistance will be treated in the same manner as he who asks for it.

9. Stationery, including Blotting-paper and Drawing-paper, will be furnished for the use of the Candidates. No one can bring anything into the Room with him, except an inkstand and a supply of such pens as he is in the habit of using.

DECLARATION.

Local Board of ____________

We, the undersigned, hereby declare that the _____ a papers on ____________ b which are forwarded herewith, were worked, in our presence, by the Candidates whose numbers they respectively bear, without any assistance whatever, from books, notes, memoranda, from each other, or from any other person. We declare that not more than three hours were occupied in working these papers, and that no Candidate was allowed to resume, or complete, his paper after having left the Examination room in the course of the time assigned to that paper; We further declare that the paper of questions given to each Candidate was taken from the envelope in which it was transmitted from the Society of Arts, the seal of this envelope being broken in our presence, and in that of the assembled Candidates, at the commencement of the time appointed for the paper in the time table issued by the Society; and, finally, we declare that not fewer than* ________ of our number were present during the whole time that the Candidates were engaged in these papers.

Name, designation, and address of members of Local Board who were present during the working of the papers referred to in the above declaration.† ____________
____
____
____
____

(a) Insert Number. (b) Insert Subject.

* State the number, which in no case must be less than *two*.

† This declaration must be signed, in every case, by, at least, *two* of the members of the Local Board; and, when more than twenty Candidates are examined at any one sitting, by, at least, *three* such members. It must not, in any case, be signed by a member of the Board from whom any of the Candidates have received instruction in the subject of the paper to which it refers.

* Except in case of Free-hand Drawing and Mechanical Drawing. For each of these subjects four hours will be allowed.

BOARD OF EXAMINERS.

The following is a list of the Board of Examiners for the present year :—

Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
MATHEMATICS.	
Algebra, Geometry, Mensuration, Trigonometry, Conic Sections	Rev. Harvey Goodwin, M.A., Cambridge. Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools. William Spottiswoode, Esq., F.R.S. Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.
PHYSICS.	
Navigation and Nautical Astronomy	John Riddle, Esq., F.R.A.S., Head Master of the Nautical Schools, Greenwich.
Statics, Dynamics, Hydrostatics	Rev. A. Bath Power, M.A., Principal of the Diocesan Training School, Norwich.
Practical Mechanics	T. M. Goodeve, Esq., Professor of Natural Philosophy, King's College, London.
Magnetism, Electricity, and Heat	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
Astronomy	Rev. Baden Powell, M.A., F.R.S., Savilian Professor of Geometry in the University of Oxford.
Chemistry	Dr. A. W. Williamson, Professor of Chemistry, University College, London.
Animal Physiology	William Sharpey, Esq., M.D., F.R.S., Examiner in University College, London.
Botany	Arthur Henfrey, Esq., F.R.S., Professor of Botany, King's College, London.
Agriculture	J. C. Morton, Esq.
Political and Social Economy	Charles Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
Descriptive Geography	Wm. Hughes, Esq., F.R.G.S.
Physical Geography	Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea. *Chairman of the Board.*
English History	E. S. Creasy, Esq., M.A., Professor of History, University College, London.
English Literature	Rev. F. Temple, M.A., Head Master of Rugby School.
Latin and Roman History	F. R. Sandford, Esq., B.A., Assistant Secretary to the Committee of Council on Education.
French	Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.
German	Dr. Bernays, Professor of German, King's College, London.
Freehand Drawing	F. S. Cary, Esq.
Mechanical Drawing	Thomas Bradley, Esq., Professor of Geometrical Drawing, King's College, London, and Master at the Royal Military Academy, Woolwich.

TWENTY-SECOND ORDINARY MEETING.

WEDNESDAY, MAY 12, 1858.

The Twenty-Second Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 12th inst., William Brown, Esq., M.P., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Baylis, Charles	Quain, Richard, M.D.
Heywood, James	Watts, William Henry

The CHAIRMAN said we must all feel much indebted to gentlemen who undertook the duty of travelling for the purpose of enlightening those who remained at home, and who, by the publication of their observations and researches, made us acquainted with countries in which we could not but feel the deepest interest, and who gave us an account of the climate, scenery, productions, population, social condition, and, above all, healthfulnesss and general adaptation for the settlement of European emigrants, of our colonial possessions. In this respect, therefore, we were greatly indebted to Professor Wilson for having undertaken to read a paper on the subject of Canada, which he was sure would be listened to with great interest. He would, therefore, without occupying the time of the meeting further, call upon Professor Wilson to favour them by reading his paper.

The Paper read was—

ON CANADA—ITS PRODUCTIONS AND RESOURCES.

BY PROFESSOR JOHN WILSON, F.R.S.E.

There are three important epochs in the history of Canada. In the year 1534, Philip Chabot, Vice-Admiral of France, with his able and enterprising lieutenant, Jacques Cartier, sailed into the Gulf of St. Lawrence, and, hoisting his flag on the mainland, took possession of it, in the name of his country.

In 1760, the fierce and bloody struggle, which had been carried on with intermissions and varying success between the North American colonies of France and England for upwards of eighty years, was finally decided upon the heights of Quebec, by that glorious and ever-memorable battle, in which the rival commanders, Wolfe and Montcalm, both fell—the life-blood of the one ebbing fast as the shouts of victory reached his ears—while the other's spirit had happily passed away, while the victory was yet uncertain, and the pangs of a defeat unknown. From this time the French rule in Canada ceased, for in the following year a formal deed of capitulation ceded to England the right to all her North American possessions;—and New France, as they were termed, ceased, from that time, to be a dependency of the French crown.

In 1851, when Industry received her great ovation in Hyde-park, and all the civilized countries of the world were assembled under one roof—few representative collections excited more gratification, and none more surprise, to the observant visitor, than that which was displayed under the banner of youthful Canada. To many, it is true, it possessed not the attractions of the luxurious though barbarian East—it attempted no rivalry with the high class industry of older countries; the gorgeous gems and highly-wrought minerals of Russia—the magnificent exponents of France's high civilization—the more solid, though still equally advanced, manufactures of Central Europe, were none of them included in her collection. In the place of these luxuries of life, we found its necessities, its stern realities, forming the main object of her display. Some few manufactures, either special to the country, or sufficient to show its progressing condition, were, it is true, exhibited, but the great feature of the collection, that which invested it with such general interest, was the magnificent display of "raw produce," which showed, beyond a doubt, the value and vast industrial resources of a country, whose loss to its former possessor occasioned only the consolatory remark, by the Minister of the day (M. de Choiseul-Stainville), "After all, what signify a few acres of snow in Canada."

The success achieved in Hyde-park, in 1851, was even exceeded in Paris, in 1855, when Canada, an independent and self-exhibiting colony of Great Britain, sustained a successful rivalry with Algeria, the favoured colony of France, varied and admirable though her contributions were, and displayed with all the acknowledged taste and great resources of the Imperial Government. Then it was, in the capital of her ancient mistress, that the contrast between the past and the present state of Canada first most forcibly presented itself, and drew from the lips of Count Jaubert, when examining the magnificent representations of her agriculture, that expression of regret, mingled with admiration,* "Now we can indeed form an estimate of the value of those few acres of snow ceded to England with such culpable negligence by the Government of Louis XV." Richly did the collection deserve the encomiums universally bestowed upon it, and Canada stands registered in the memory of France under the descriptive title of "A land of hope, not likely to be disappointed. Active, intelligent, enterprising beyond all other distant nations, which equally abound in the elements of industry and production, she claims and demands our attention."

These opinions, expressed publicly and officially—and I could readily multiply them,—surely carry with them points worthy of our consideration at home—where, I believe, the actual condition of Canada is still very imperfectly known, especially by those classes to whom such knowledge would prove of the greatest benefit; and it is principally with a view to afford this information, that I have been invited to give you this evening my impressions of "Canada: its Productions and Resources,"—impressions formed from personal observation, and from data which, from time to time, have been kindly furnished to me.

To give these in the most succinct manner, I propose to divide them under the following heads: history—geological formation and physical geography—natural productions and capabilities—trade statistics—actual social condition, and general considerations. And I can only attempt to give them in the briefest and most condensed form, as the time allowed me is really insufficient to do full justice to either section of my subject.

The only portion of the history of Canada to which I shall make further allusions, will date from the third epoch—that of 1851—when public attention was first drawn to the condition and capabilites of the colony, by her industrial *débût* in Hyde-park, when thousands of wondering visitors went home and rubbed up their geography anew, in order to be assured of the existence of a country which, under the general name of America, had, by the many, been too generally confounded with the United States. And this portion I can refer to more appropriately when I submit to your consideration the industrial statistics of this progressing country.

* *La Botanique de l'Exposition de* 1855.

Geology and Physical Geography.

That map which hangs on the wall, with its distinctive geological colourings, is, to my mind, most important evidence of the progressing civilization of its country. Thanks to Sir W. E. Logan, the able and indefatigable Director of the Geological Survey of Canada, I have an opportunity not only of showing you how far he has determined the actual geology of the vast country under his charge, but he has also kindly made me acquainted with the results of his preliminary explorations during the past year, which, as they relate more particularly to the surface geology, have a material bearing upon the agricultural capabilities and general settling character of the districts visited. In the ranks of science there are few men whose correctness of observation and judgment and whose opinions are more valued and relied on than those of Sir W. E. Logan.

Prior to the year 1840, Canada was divided into two distinct provinces, known as upper and lower, possessing separate legislative bodies or parliaments for each. In 1840 these provinces were united, although for some purposes the old territorial divisions still exist. The River Ottawa is the division line between the two portions on the north side of the St. Lawrence; and the 45th parallel of latitude on the south side of the river. The entire Province is bound on the north by the British possessions, at present in the hands of the Hudson's Bay Company; on the south and east by the States of the Union, and the British province of North Brunswick. The west boundary, west of Lake Winnipeg, is yet undefined. The great River St. Lawrence and the vast chain of inland lakes—Superior, Huron, Erie, and Ontario—form a wonderful and natural barrier between Canada and the United States, affording at the same time a means of transport and communication of unsurpassed excellence and importance to both.

The area of the Province, without its north-western possessions, is computed at 360,000 square miles; of which about 40,000 only are at present occupied. Its form is that of a parallelogram, stretching south-west and north-east, with an extreme length of about 1,200 miles, by a breadth of 300 miles. The limits of the country extend from the 60th to the 84th degree west long., and from the 42nd to the 52nd deg. parallel of lat.

Throughout the whole of its length the Province is traversed by a mountainous region, dividing it into two basins, which may be distinguished as the north and south basins. This range which has been termed the Lawrentides, form the north shore of the St. Lawrence, from the Gulf as far as Cape Tourment, near Quebec, from which point they leave the river, and while they follow its general direction they withdraw from it, until, near Montreal, we find their course to be at a distance of 10 leagues. In a westerly direction the mountain chain follows the course of the Ottawa river, which it crosses near the Lac des Chats, fifty leagues from Montreal; then, taking a turn to the south, it again comes on to the St. Lawrence near the outlet of Lake Ontario, and from this point trending towards the north-west, the south limit of the formation reaches the south-east extremity of Lake Huron at Matchedash Bay, and forms the east shore of the lake as far as the 47th deg. of lat., where it leaves Lake Huron, and running along Lake Superior it stretches out in a north-west direction as far as the Arctic Ocean.

On the the south bank of the St. Lawrence this formation is seen occupying an area between the Lakes Champlain and Ontario, where it is known as the Adirondack range. With the exception of this locality,

and possibly a small patch or two in Arkansas, and near the head water of the Mississippi, the formation does not occur south of the St. Lawrence, and from the circumstance of its being developed only in the valley of the St. Lawrence, the general name of Lawrentian has been given to the whole system.

The rocks forming this system are almost always sedimentary strata, which have become highly crystalline. They have been much disturbed and form ranges of hills, in which crystalline schists, of a gneissoid and hornblend character, and crystalline limestones, associated with feldspars predominate. The beds of crystalline limestone form important features in this formation. They occur in beds of from a few feet to 300 feet in thickness, and with them various strata of dolomite and of other limestones of a less compact nature and more or less magnesian are found, which aid greatly their disintegration and formation into soils. This system is equivalent to the gneissoid rocks of Scandinavia and Scotland.

The Huronian (our Cambrian) occurs chiefly on the shore-line of Lakes Huron and Superior, and consists of a series of schists, sandstones, limestones, and conglomerates, interstratified with thick beds of greenstone, largely disturbed by the irruption of trap dykes, and resting uncomformably upon the Lawrentian beds.

The Silurian system is also largely developed in Canada, covering the inclined strata of the Cambrians of the island on the north side of the Huron, and lying immediately on the Lawrentian throughout the entire range of their outcrop in the valley of the St. Lawrence; indeed, with the exception of a small area of the Devonian system, the whole of the Canadian portion of that great basin, which is bounded to the north by the Lawrentian and Huron rocks, belongs to this system. The lithological characters of these rocks are the same as with us, alternating beds of shales, sandstones, and limestones of variable compactness, the value and character of the soils formed from them being due to the relative proportion and admixtures of the different beds. The Devonian (with the exception of small patches of the Carboniferous) are the highest or most recent formation met with in Canada, and is only met with at the lower end of Lake Ontario, and at the south-east extremity in the district of Gaspé. These beds generally disintegrate readily, and are looked upon as affording evidence of a fertile surface.

The carboniferous system is unhappily limited in Canada to its least valuable representative, the mountain limestone and the millstone grit, and which, indeed, occur only to a very limited extent. We must go beyond the boundary line of the province for those valuable deposits of coal which the neighbouring provinces of Nova Scotia, New Brunswick, and Newfoundland are so abundantly provided with.

Although coals cannot be reckoned in the rich list of her mineral wealth, well nigh every other production of the rocks is to be found among her stores.

Of *Iron Ores* numerous deposits exist. Hæmatites at Marmora, Madoc, Sherbrooke, Bedford.

Spathic Ores—Wallace, Lake Huron, McNab, St. Arnaud, Sutton, Brome.

Bog Ores at Middletown, Charlotteville, Eardley, Templeton, Champlain, Portneuf, Standbridge.

Titaniferous Ores—Vaudreuil, St. Urbain.

Zinc Ores at Prince's Mine, Mamainse (Lake Superior).

Lead Ores at Fitzroy, Lansdowne, Ramsay, Bedford, Maimanse, &c.

Copper Ores and Metallic—Lake Superior, Lake Huron, Inverness, Leeds, Upton (argentiferous), Ascot (containing gold and silver).

Nickel—Michipicoten (Lake Superior), Wallace Mine (Lake Huron), Ham, Bolton.

Silver—Lake Superior, Michipicoten, and Prince's Mine.

Gold—Beauce County, auriferous region in alluvial sands, extending over an area of 10,000 square miles contained also in the ores of Prince's Mine at Ascot and other places.

Uranium—Yellow oxides at Madoc.

Chromium at Bolton and Ham.

Cobalt—Prince's Mine (Lake Superior).

Manganese—Bolton, Stanstead, Beauce, St. Anne.

Barytes—Bathurst, Mc Nab, Lansdown.

Graphite—Grenville, Fitzroy.

Lithograph Stone—Marmora, Rama, Lake Couchicing.

Gypsum—Dumfries, Brantford, Oneida, Seneca, &c.

Phosphate of Lime—Ottawa, Burgess, Calumet, Hull.

Millstones—Bolton, and other places in the eastern townships.

Grindstones and Whetstones—Marmora, Madoc, Stanstead, Bolton, Shepton, Marston.

Building Stones—Granites, sandstones, and limestones, are largely distributed all over the country.

Hydraulic Limestones at Point Douglas, Paris, Cayuga, Thorold, Kingston, Hull, Quebec.

Roofing Slates—Kingsey, Halifax, Melbourne, Riviere du Loup.

Paving Stones—Toronto, York, Bagot, Horton, Inverness.

Clays, suitable for bricks and rough pottery, are found everywhere in the valleys of the St. Lawrence, Ottawa, and Richelieu rivers; for finer goods, at London, Toronto, Coburg, Peterborough.

Marbles, various in colour and pure in quality—white, at Philipsburg; black, at Cornwall; red, at St. Lin; brown, at Pakenham; yellow and black, at Dudswell; grey, &c., at McNab, Montreal, St. Dominque; green, at Grenville, Stukely, Brompton, Oxford.

Peat at Humberstone, Wainsfleet, Goulbourn, and numerous other localities.

Petroleum—on the Thames, River St. Jean, and Ruisseau Argenté (Gaspé).

Asphaltum—Enniskillen.

This slight sketch of the mineral produce of the country, so far as at present explored, is, or ought to be, sufficient to show what immense resources can be offered to industrial enterprise when agriculture has occupied her surface and pioneered the way, and few countries can offer more temptation to the occupier of the soil. Although Canada has been denuded of all those secondary and tertiary formations which give such interest to the geology of our own country, the older rocks, which we are accustomed to associate with ideas of a thin, cheerless, and unfertile surface, have been largely covered up by post-tertiary, the most recent of our terrestrial deposits. Here we have both the chemical and physical elements of fertility, and happily these are spread over extensive areas throughout the Province. The greater portion of the surface of the country is occupied by the inter-stratified clays and sands of these deposits, giving, according to their relative admixtures, every variety of texture, and forming soils of great fertility, especially when in contact with the outcrops of the limestones and feldspars of the subjacent rocks. In this formation those beds of peat are met with, which, in the absence of coals, and with the decreasing supplies of wood, are already becoming of importance to the district in which they occur.

You have only to run your eye over the map of Canada, and you will see the admirable disposition of land and water throughout the entire extent of the country; the magnificent St. Lawrence, the backbone of the system, with its head waters in Lake Superior and its other extremity in the broad Atlantic, 2000 miles off, is the main link in the chain of Canada's present and future prosperity. Along the waters of this grand river, every district of Canada, aye, and of the mighty "West" too, finds a high road to the ocean—there free to take its produce to the markets that pay the best. Its tributaries, some hardly inferior in importance to itself, stretch right and left into regions where the woodman's axe alone breaks the solitude of the primæval forest, and connect the lakes

and rivers of the interior with the ocean—and with those better known to us, on whose shores man has fixed his abode. Look at the Saguenay, with a tidal range of 10 ft. to a distance of 80 miles from its mouth; the St. Maurice, with a length of some 300 miles; the Richelieu—connecting Lake Champlain with the St. Lawrence; the Ottawa, or Grand River—a river destined to occupy an important page in the future of the country—not only as a rival highway for the commerce of the west, but as possessing on its banks the newly-chosen Capital of Canada.

The enormous fresh water lakes or inland seas are too well known to need more than a passing notice. The first we come to, 756 miles from the sea and 234 feet above its level, is Lake Ontario, 180 miles long and 50 miles wide, with a depth of 100 fathoms, and having a surface area of nearly 6,600 square miles. Then comes Lake Erie, 1,041 miles from the sea, and 564 feet above its level, the difference in level being overcome by the Welland canal, one of the finest specimens of canal engineering in the world. Here we have an expanse of water 240 miles long by 54 miles broad, covering an area of nearly 12,000 square miles. Crossing the small Lake St. Clair, 24 miles long by the same in breadth, we reach Lake Huron, 240 miles long by 90 miles broad, with a surface area of about 18,000 square miles, at a distance of 1,350 miles from the sea, and 573 feet above its level. We now approach Lake Superior, the head waters of the St. Lawrence—a short but stupendous canal, constructed by the United States, connecting the two lakes, and completing the chain of navigation for sea-going vessels 2,000 miles into the interior of the country. The vast expanse of water of this lake, the largest in the world, with a length of 333 miles by 160 miles broad, giving a surface area of 32,000 square miles, is at present the end of the St. Lawrence navigation; but a glance at the map will show you that there are chains of rivers and lakes stretching far out into the north-west which some day will play the same part as those already named have done in the advancement of civilisation, and be made subservient to the purposes of man's welfare.

This bountiful distribution of water, and beautifully developed river system, has a broad bearing not only on the general welfare, but upon the very existence of the country. The great and ready powers of transport it affords are as nothing compared with its influence over the climate, the vegetation, and the health of the country. In these we recognise the bounteous provision which gives to the inland portions of the country almost an insular climate, and softens down those extremes of temperature which form such permanent barriers to the occupation of the "mighty West."

The two points most affecting climate and vegetation are temperature and rainfall. Let us see what the meteorological records of Her Majesty's Observatory at Toronto tell us. We have a digest of the range of the thermometer for 11 years, from 1840 to 1850 inclusive:—

	Max.	Min.	Range.	Mean.
January	45.33°	4.41°	49.74°	24.67°
February	46.35	4.37	50.72	24.14
March	53.31	7.59	45.92	30.83
April	71.44	17.96	53.48	42.17
May	76.76	28.82	47.94	51.84
June	76.44	35.72	40.72	61.42
July	88.11	44.05	44.06	66.54
August	83.98	45.02	38.95	65.76
September	80.19	32.07	48.12	57.11
October	66.10	22.17	44.30	44.50
November	57.03	13.38	43.60	36.57
December	45.25	3.52	46.27	27.18

Annual Mean, 44.39°.

These data show us that February is the coldest, and July the hottest, month in the year; that there are four months—December, January, February, and March—when the average temperature is below 32°; there are three months—April, October, and November—during which the temperature remains below the mean temperature of the year; and that there are five months—May, June, July, August, and September—when the temperature is above the annual mean, and which constitute the growing season in Canada.

The average rainfall, calculated from the records of a series of years, gives the following results:—

	Days.	Inches.
January	4.6	1.701
February	3.9	1.088
March	5.7	1.613
April	8.7	2.571
May	10.3	2.975
June	10.7	3.042
July	8.9	3.720
August	9.3	2.719
September	10.6	4.458
October	11.2	2.929
November	9.2	3.026
December	5.1	1.522

Thus showing an average rainfall of 31.364 inches occurring on 97.3 days, and distributed nearly equally over the agricultural year.

To this must be added the average snow-fall, which amounts to 61·9 inches per annum. If we compare the extremes of temperature (taking summer and winter means), between Toronto and the Western States of the Union, we find them entirely in favour of Canada.

	Latitude. Deg.	Min.		Deg.
Canada, at Toronto	43	39	the difference is	39·
Iowa, Muscatine	41	30	,,	45·
Illinois, Fort Armstrong	41	28	,,	49·05
Wisconsin, Fort Crawford	43	03	,,	50·89
Missouri, Council Bluffs	41	45	,,	51·34
Minnesota, Fort Snelling	44	53	,,	56·60

If we compare the temperature and rainfall with those of this country, we find the equally favourable results, our mean temperature being about 50°, and our average rainfall about 28 inches, occurring on 155 days, showing a slight difference in favour of Canada.

As a proof that this excess, so important to vegetation, is not so high as to be injurious to health, the vital statistics of the province, compared with those of other countries, give satisfactory evidence.

In Turkey, the deaths are to the population as	1	in 30
,, Prussia	,,	,,	,,	1	,, 39
,, Portugal	,,	,,	,,	1	,, 40
,, Spain	,,	,,	,,	1	,, 40
,, Switzerland	,,	,,	,,	1	,, 40
,, Austria	,,	,,	,,	1	,, 40
,, Norway and Sweden		,,	,,	1	,, 41
,, France	,,	,,	,,	1	,, 42
,, Belgium	,,	,,	,,	1	,, 43
,, Russia (Europe)	,,	,,	,,	1	,, 44
,, Denmark	,,	,,	,,	1	,, 45
,, England	,,	,,	,,	1	,, 46
,, United States	,,	,,	,,	1	,, 74
,, Canada	,,	,,	,,	1	,, 98
,, ,, (Upper)	,,	,,	,,	1	,, 102
,, ,, (Lower)	,,	,,	,,	1	,, 92

These remarks refer chiefly to Canada West, the meteorology of Canada East not having received the same attention. We know, however, that the extremes

of summer and winter temperature are greater in the valleys of the St. Lawrence and Ottawa than south of the 44 deg. parallel; that though the winter is somewhat longer, the air is clear, dry, and bracing. The snow usually comes on at the beginning of December, and disappears about the middle of April, remaining on the ground three or four weeks longer than in the western part of the province. This snow-fall is looked for with great anxiety, especially in the thinly-settled districts, as it furnishes a natural railroad for transport and traffic, which, in a new country, where roads are necessarily few and imperfect, is of great importance. As the country becomes cleared and inhabited, the snowfall gradually diminishes, thus appearing to obey the laws of civilisation, subserving to the wants of the settler in the early days of his necessities, and urging him to other resources as his age advances and his powers increase.

Productions and General Statistics.

I must content myself with this brief sketch of the geological and physical geography of the country, and now tell you something of its productions, which include within their wide range well nigh all the necessities and most of the comforts of life. These I may divide under three heads: the produce of the Mine—the Forest—and the Field, in each of which the present returns give good evidence of what the future will be when the country is more advanced and its vast resources more developed.

In all new countries, the productions of the surface are of more importance to the settler than those beneath it, and the undue development of its mineral wealth rarely indicates a healthy condition. In Canada, although there is ample evidence of the existence of this wealth, the energies of the people, happily, have been directed to other productions, and this branch of industry remains well-nigh intact for future enterprise. By the trade statistics, we find that the following amounts represent the mineral exports:—1853, £27,339 3s. 2d.; 1854, £74,730 13s. 1d.; 1855, £31,458 15s. 8d.; 1856, £41,411 18s. 8d.; the greater proportion of which is from the Lake Huron copper mines.

The productions of the Forest are more numerous and more important. Of course, timber in its varied shapes is the principal item, potashes and peltry furnishing the other amounts. These returns, which we have from 1851 inclusive, give the following results:—1851, £1,515,878 19s. 6d.; 1852, £1,614,584 14s. 9d.; 1853, £2,355,255 2s. 2d.; 1854, £2,495,341 16s. 10d.; 1855, £1,986,980 16s. 10d.; 1856, £2,504,970 15s. 5d.

The productions of the Field are the true tests of a country's wealth and of its progress. By these we can form the safest estimates of its present as well as future capabilities; and I need not remind you of the vast, the direct, and the increasing importance of the relations between corn-consuming England and her corn-producing colony. The returns here give us evidence of the most satisfactory character.

	1851.			1852.			1853.		
	£	s.	d.	£	s.	d.	£	s.	d.
Vegetable Produce...	941,597	18	8	1,157,008	8	4	1,992,811	10	7
Animal Produce	......			......			342,631	7	0
Total	......			......			2,335,442	17	7

	1854.			1855.			1856.		
	£	s.	d.	£	s.	d.	£	s.	d.
Vegetable Produce...	1,882,680	2	8	3,257,599	18	2	3,743,068	17	8
Animal Produce	208,318	4	2	398,796	0	6	641,014	16	11
Total	2,090,998	6	10	3,656,395	18	8	4,384,083	14	7

Another source of wealth exists in Canada, which, up to the present time, has hardly received the attention it deserves, and which offers a field for almost unlimited enterprise; I mean her fisheries. Along the shores and large rivers a continual harvest might be gathered in, and that too without lessening the productive powers of the field. Unlike the rock embedded minerals, limited in their quantity, and without the powers of increase, and which will bide their time without injury or decrease until the advancing industry of the country calls them from their earthy beds,—the denizens of the water form no item in a country's wealth and no part of its available resources, while they remain within the bosom of their natural world. Every one of these transferred from the water to the shore is as so much added to the wealth of the country.

The following returns show that some attention, however, is being directed to them:—1853, £85,000 13s. 8d.; 1854, £87,427 15s. 6d.; 1855, £114,980 1s. 0d.; 1856, £114,086 13s. 7d.

These tabulated figures represent the surplus wealth in productive industry only. We find, however, that manufacturing industry is sufficiently advanced to pay its tribute to the export trade of the colony. Under the head of manufactures and sundries we see its present condition:—1853, £64,507 5s. 3d.; 1854, £65,406 5s. 1d.; 1855, £136,159 19s. 9d.; 1856, £104,206 14s. 8d.

Under this head, also, we must include the returns of shipbuilding, which, though subject to great variations, is carried on to a considerable extent in the port of Quebec. These show a money value of—1853, £620,187 10s.; 1854, £552,062 10s.; 1855, £304,886 5s.; 1856, £303,269 7s. 6d.

If to these several amounts we add the estimated value of exportations to inland ports, which were as follows:—1853, £447,268 5s. 5d.; 1854, £442,470 3s. 3d.; 1855, £816,253 8s. 4d.; 1856, £559,725 0s. 0d., we arrive at the total value of the exportations of the Colony.—1851, £3,241,180 3s. 9d.; 1852, £3,826,901 15s. 5d.; 1853, £5,950,325 15s. 4d.; 1854, £5,754,797 10s. 9d.; 1855, £7,047,115 5s. 3d.; 1856, £8,011,754 4s. 5d.

When we turn to the home records of the colony, we find evidence of its condition and progress equally satisfactory. In 1851 the gross amount of wheat grown was 16,202,272 bushels, showing an increase of 400 per cent. during the 10 previous years, while, in the United States, the increase had only reached 48 per cent. In oats the produce increased 70 per cent., while that of the States was only 17 per cent. Even in Indian corn Canada compares favourably with the States, her increased production being equal to 163 per cent., while that of the States was only 56 per cent. But perhaps these points would be best understood by comparing them with those of a separate State of the Union, which should be a fair representative of its productive condition. Ohio has been selected for the comparison, and those who know that State will acknowledge that Canada has chosen no mean competitor. The land in Ohio is valued at nearly double that of the average of the Union, and has more than three times as many inhabitants to the square mile, she having 49·55, while the average of the Union is only 15·75. Let us look at some of the principal items. (See the table in the next page.)

These were the statistics of 1851, since then the country has been advancing at even a more rapid rate. In 1851 the gross wheat produce amounted to 16,155,956 bushels, in 1856 to 26,555,684, showing an increase of 10,399,738 bushels, which is equal to 64·3 per cent. in the five years, and raises the return from 8·9 bushels to 10·6 bushels per head of population. In barley and rye the returns are even more satisfactory, the surplus produce of 1855 being 566,534 bushels, while that of 1856 was 989,447, showing an increase of 74·5 per cent. in one year. In Indian corn an increased ratio of increase is seen, the exports of 1855 being 73,066 bushels, those of 1856 being 164,495, the increase amounted to 125 per cent., but even this is exceeded by that of oats, which present an increase of 250 per cent. in one year,

	CANADA.	IN OHIO.
Population	1,842,265	1,980,427
Acres occupied, cultivated	7,300,839	9,851,439
,, ,, uncultivated	10,638,957	8,146,000
Total occupied	17,939,796	17,997,493
Acres occupied to each inhabitant	9 3 4	9 0 18
Acres of Wheat	1,136,311	1,231,437
Produce in bushels	16,155,946	14,487,351
Bushels per acre	14·2	12
Bushels per inhabitant	8·9	7·3
Assessed value of occupied Lands	£65,879,048	£89,689,651
Oats, produce in bushels	21,434,840	13,472,742
Barley ,, ,,	1,389,499	354,358
Rye ,, ,,	869,835	425,718
Peas ,, ,,	4,223,487	55,168
Cows	591,438	544,499
Horses	385,377	463,397
Sheep	1,597,849	3,942,929
Cattle	741,106	814,448

the quantity exported in 1855 being 370,275 bushels while, in 1856, it amounted to 1,296,677 bushels. The ratio of increase in the productions of the field appears to increase with that of the population; this latter, however, presents some remarkable features.

In 1763, the population of Canada is given at 82,000; 1814, 430,000; 1823, 575,000; 1831, 772,000; 1844, 1,199,000; 1848, 1,491,000; 1851, 1,842,265; 1856, 2,500,000. If we compare these returns with those of the States and also of this country, say for the last decennial census, we can form some idea of the relative population progress of Canada. In Great Britain the increase amounted to 13·2 per cent.; in the United States to 35 per cent., while the population of Canada increased 69 per cent., or if we were to take the western province alone, we should find an increase of no less than 104 per cent. in the ten years. This increased population appears to be the very life blood of the colony. It fills up and consolidates the body of the older settlements, and extends the boundaries of civilisation by spreading out and founding new ones. The returns of surplus produce already quoted, increasing in their ratio with the increase of population, show that the most important element of progress is an increased population. This would naturally follow the course of time, or might be accelerated by immigration, and to this latter mode the government of Canada has very successfully addressed itself. This is a question, too, in which we have a direct interest, whether we view it in its commercial or imperial bearing. We have seen what the colony can supply to our necessities, let us now look at her imports, and see what in return she can* consume of our manufactures. The value of the imports into Canada were, in

	£	s.	d.
1841	2,694,160	14	6
1850	4,245,517	3	6
1851	5,358,697	12	7
1852	5,071,623	3	11
1853	7,995,359	1	1
1854	10,132,331	6	9
1855	9,021,542	7	3
1856	10,896,096	16	2

Thus, while the export trade since 1851 shows an increase of, in round numbers, 150 per cent., the imports have fully doubled themselves in the same period.

* In the tables it must be understood that the money amounts are in the currency of the country, and that about one-half of both the exports and imports are transacted with the United States.

If we take the present productive returns of the cultivated lands as a basis for our calculations, it would be seen that the already occupied land in the colony would support a population of about 10,000,000 inhabitants, and if the present progressive rate of increase is sustained, a writer in "Hunt's Merchants' Magazine" tells us, that at the close of the present century we may expect to see Canada occupied by a population something like 20,000,000 in number. Whatever her numbers may be, it is quite certain that for years to come the great strength of the country will lie in the productions of her soil. With these she will pay for our manufactures; her surplus will supply our wants, and our surplus will administer to her necessities and comforts, and thus the scales of commercial benefit be kept pretty evenly balanced.

Social Condition, &c.

It is quite clear, I think, that there is ample space in Canada for a largely increased population, and it is equally clear, if we may judge from the past, that every increase is followed by a generally increased prosperity. To induce this by means of immigration, the government have lately offered free grants of land along three great arterial lines of road, which have been recently opened up and laid out for settlement. (These you will see marked on the map lying between the Ottawa and Lake Huron.) The grants are not to exceed 100 acres to each, and are offered on the following terms:—

1. That the settler be 18 years of age.
2. That he take possession of the land allotted to him within one month.
3. That he put into cultivation 12 acres of the land in the course of 4 years.
4. That he build a log house 20×18 feet, and reside on the spot until the conditions be fulfilled.

Families may reside on a single lot, and the several members having land allotted to them will be exempt from building and residence on each individual lot.

These lands are generally of very excellent quality, and well-adapted, in respect to soil and climate, to all the purposes of husbandry.

Australia excepted, no country can furnish such singular instances of the rise in the value of surveyed lands as the last five years have witnessed in Canada. The development of the railway system throughout the Province has been the principal agency by which this has been effected. When we recollect that 1852 saw Canada without a single railway, and that 1857 saw her with 1,500 miles completed, and 500 miles more in process of construction, the rise in the value of land is readily understood. The lines of railway must be looked upon as a series of accessible markets for the country they serve. The natural consequence is, that every product of the farm has acquired a certain money value, although before this new access to market it may have been absolutely valueless. The immense remuneration thus obtained for the same outlay of labour has greatly enhanced the value of capital. Land in old settlements, remote from lake ports, has doubled itself in value in five years; while wild lands in new settlements, near to which a railway passes, have trebled their value within a shorter period. These all-powerful means of communication have opened up the country, made available a vast amount of inert wealth, stimulated industry, and effected a complete revolution in farming economy within a range of twenty miles on either side of the course they take.

In all countries similar results have followed the introduction of railways, but in Canada, where lakes having formed the chief means of intercommunication, which were closed to all traffic during the winter months, the results are naturally more felt and more strongly marked. If we turn to the map we see the numerous lines already intersecting the centres of industry and population, while the Great Western Railway, running

from Niagara to Detroit River—some 230 miles—and the Grand Trunk line stretching from Lake Huron in the west, down to Trois Pistoles on the east, connect all these lines with each other, and also with the seaports both of the St. Lawrence and the open Atlantic. This gigantic undertaking, rivalling in its magnificence the great river system of North America, already has 849 miles in traffic operation. Its length, when complete, will be 1,112, and it will stand first among the railways of the world, not only on account of its exceeding length, but more especially for that triumph of engineering skill, which will carry the line of rails across the broad and rapid St. Lawrence, by a tubular bridge, of stupendous proportions, and nearly two miles in length. This (which is to be called the Victoria Bridge) will be complete and open for traffic in 1860; fourteen piers out of the twenty-four are finished, and it is expected that eight or nine of the tubes will be in their places by the end of the current year. The expenditure, so far, has amounted to £712,192, out of £1,250,000, the contract price.

Whatever may be the results of these railways as mere objects of investment, whether at first they are remunerative or not, this much is beyond question, that the extent and nature of the benefits they confer on the districts which they serve cannot be too highly estimated. The railway policy of Canada has been successful, from its boldness and completeness—it has had all the advantages of home experience and home capital; home interests are largely mixed up with its success—and one of the best ways to ensure that, is to make known, far and wide, the advantages it offers to those who are about to seek a new home in the fertile lands of the Western world. I regret that my time will not allow me to give you any details of the admirable arrangements by which the traveller or the emigrant is conveyed for *one payment* from the principal ports of this country, or, indeed, of Europe, to the confines of Canada, and farther still, the extreme boundaries of the United States—Kansas, Nebraska, or Texas; neither can I do more than give a very slight sketch of the great water highway, along which a vessel, sailing from Lake Michigan, finds its way to the broad Atlantic, and, in due time, hands over to the merchant at Liverpool the goods that were shipped at Milwaukie or Chicago. The natural difficulties of the great water roads of the country have submitted to the skill of man, and the canals, both proper and subsidiary, justly rank among the most successful evidences of Canadian enterprise.

The greatly increasing land traffic developed by the railways is urging forward a demand for increased facilities by water, to supplement either their area of service or their carrying powers. Already we find (by last half-yearly Report of the Grand Trunk Railway) a line of screw steamers of large tonnage preparing to run from the Michigan ports to Collingwood—the Northern Railway terminus, on Lake Huron—while at South Quebec, the principal terminus of the Grand Trunk Railway, a very important undertaking, of considerable magnitude, is already in active progress, under the title of the "St. Lawrence Dock and Wharfage Company," which will go far towards making Quebec the Liverpool of the North American continent. To this point of the river the largest sea-going vessels can come, and now find a safe and commodious harbour, with every arrangement for their traffic purposes; and from this point a daily service of screw steamers of lighter draught will start, and deliver or collect cargoes for them from the river, or lake ports of the interior, while another line will keep Quebec in direct communication with the Lower Provinces on the Gulf. This, too, from the great facilities offered, will probably be the station of departure and arrival of the trans-Atlantic steamers, of which three distinct lines already connect the two countries together. These steamers are thronged even now with American travellers,* and when the communication with the Western States is fully opened up, we may easily imagine what the effect will be.

So far, I have not touched upon the cities of Canada, and I must still leave them unnoticed, save that one, "Ottawa," which has quite recently been constituted the Capital of this great country. In former times the seat of goverment has been by turns in Quebec, Montreal, Kingston, and Toronto. For reasons, which I cannot enter on this evening, it was considered desirable to fix a permanent position for the government, and as each of the cities named put in a claim for that honour and advantage, the Canadian people, through their representatives, wisely resolved to submit the question to the Queen, and accept the Royal decision. This decision was given without favour to any rival claims; a neutral city was chosen, offering great advantages, present as well as future, for the seat of Government, and situated so as largely to partake of all the facilities of communication with the various portions of the country in its charge.

The new capital stands at the mouth of the Rideau River, on the south-west side of the River Ottawa, that great river, second only to the St. Lawrence, which divides the upper province from the lower; the city is at about eighty-seven miles from the confluence of the Ottawa with the St. Lawrence. The river here is about half a mile broad, the two banks being connected by a fine suspension bridge, erected by the Provincial Government. The population is at present about 10,000. The great facilities it offers for manufacturing and commercial industries, owing to its water communications, and immense water powers, combined with the various charms of the newly acquired title of capital, will no doubt rapidly increase its numbers. The scenery round the city is of unsurpassed beauty—wild, romantic, picturesque, and presenting a variety rarely to be met with elsewhere. It is already the centre of the largest "lumbering" district in Canada, and minerals have been successfully worked in the district for some years past.

Between the shores of the Ottawa and Lake Huron lies a territory rich to profusion in mineral wealth, and vast forests which will afford for many years to come the source of profitable employment to the hardy labourer. As fast as the axe of the woodman levels the forest, the plough of the agricultural emigrant will turn up the soil, and rich harvests will be won for the supply of the extensive markets of the old and new worlds. But beyond this tract of timber and mineral lands, through which must shortly flow the waters of the Huron to mingle with those of the Ottawa, lie other lands yet unexplored, and unsubdued to the wants of civilization.

Across the inland sea of the Huron there are the Red River settlements, the very garden of the Hudson's Bay territory, over which monopoly and exclusion have so long thrown a veil of mystery,—but, from which, despite all restriction, there reach us rumours of rich and fertile lands, of abundant harvests, and of exhaustless wealth in the waters, the forests, and the mines. Still westward lies a vast tract of territory, the solitudes of which have been rarely disturbed, save by the trapper or the Indian hunters in pursuit of the wild animals for their furs. Century after century has passed over the regions watered by the noble Saskatchewan; the natural produce of the soil has decayed upon it year after year—the leaves of the dark forests have fallen in hundreds of succeeding autumns, and have enriched the plains to an extent with which even the most highly cultivated lands of old countries can bear no comparison. Nature has given not only a fruitful soil but a genial climate to

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* Quebec to Liverpool...... 2,500 miles.
Portland to Liverpool ... 2,750 „
Boston to Liverpool...... 2,790 „
New York to Liverpool . 2,980 „

these regions, and magnificent crops of golden grain of all kinds must reward the industry of those pioneers of civilization, who, at no very distant day will awaken the slumbering echoes of this hitherto sealed land.

That this description is not overdrawn, Mr. Hinde's recent Report* to the Government bears testimony. He tells us that the area of cultivable land of the first quality in the valley of the Red River, and its affluent, the Assinniboine, within British territory exceeds 1,200,000 acres, and that the land adapted for grazing in the same valley exceeds 3,000,000 acres; that all crops cultivated in Canada succeed well, and often show a yield far in excess of Canadian returns; and that the climate, which is a few degrees more extreme than at Toronto, is well adapted for all the operations of husbandry. Sir W. Logan, too, tells us of the favourable geological features of the Ottawa and Lake Huron district, while in the reports of his able assistant, Mr. Murray, we find tracts of hard wood lands, sure indications of agricultural fertility, being met with throughout the entire country.

It is in this region that the government allot the free grants of lands, which certainly offer great natural advantages to the hardy settler.

The report of another of Sir W. Logan's staff, Mr. Richardson, has called public attention to Anticosti, an island in the Gulf at the mouth of the St. Lawrence river. This large island, 135 miles long by 35 to 40 miles in its widest parts, and containing about 1,500,000 acres, is up to the present time totally unoccupied,—its only inhabitants, few in number, being engaged in attending the lighthouses and in hunting pursuits. This state of things will not long remain, as, thanks to the Geological Survey, we now know that the surface of the island is admirably suited to agricultural purposes. "The easily disintegrating character of the rocks forming the subsoil can scarcely fail to have permitted a great admixture of their ruins with whatever drift may have been brought to constitute a soil, and it is reasonable to suppose that the mineral character of these argillaceous limestones must have given to those *débris* a fertile character. It is precisely on such rocks, in such a position, and with such an attitude, that the best soils of the west peninsular of Western Canada, as well as those of the Genessee country, in the State of New York, are placed. I have seen nothing in the actual soil," says Mr. Richardson, "to induce me to suppose that, in so far as soil is concerned, Anticosti will be anything inferior to those regions, and considerations of climate only can induce the opinion that it would be in any way inferior to them in agricultural capabilities. The three months that I was on the island were altogether too short a time to enable me to form any opinion upon the climate of Anticosti. But taking into view the known fact that large bodies of water are more equable in their temperature than large surfaces of land, I should be inclined to suppose that Anticosti would not be so cold in winter, nor hot in summer, as districts that are more inland and more south, and that it would not compare unfavourably with any district between it and Quebec. While the autumn frosts would take effect later at Anticosti, the spring would probably be a little earlier at Quebec. But such is the condition of the island at present, that not a yard of soil has been turned up by a permanent settler, and it is the case that about a million of acres of good land, at the very entrance from the ocean to the province, are left to lie waste, while great expenses are incurred to carry settlers to the most distant parts of the west."

Another important settling country of great prospects, lying between Quebec and the Gulf, has been discovered by Sir W. Logan, the details of which will be given in his next report to the Provincial Government. In a recent letter he says:—"Last summer one of my exploring parties visited the valley of Lake St. John, on the Saguenay. After passing the gneiss rocks, which give such grandeur to the scenery of the Lower Saguenay, and such a forbidding agricultural aspect to the land for a breadth of 50 miles, this party were very much surprised to find themselves in a valley, which, though 2 deg. north of Quebec, has a climate mild enough to ripen Indian corn and grow excellent wheat, and, in fact, to produce all that is produced between Montreal and Kingston. They went forward into this valley to the westward for 75 miles; it had then a breadth of 50 miles, and the boundaries of it on each side appeared to run on far enough to give 30 miles more in length, so that we may say 5,000 square miles of a good settling country were visible. The soil was generally argillaceous, and the entire valley appeared to be underlaid by lime-feldspar. Settlement is gradually extending into it, and the inhabitants are very prosperous."

Let me now briefly recapitulate the amount of accommodation which Canada offers to new settlers, and you will have a good idea of the enormous resources of the country. Her present population is about 2,500,000, while her lands already occupied are equal to the support of a population of 10 millions. Then we have Anticosti, with its million of fertile acres; the St. John's Lake Valley, where upwards of 3,000,000 acres have already been made known; and, lastly, the important districts lying between the Ottawa and Lake Huron, where government allotments are now being made. Beyond these, the vast territories of the N.W. stretch out their arms wide enough to receive the surplus population of the old world for well-nigh all time to come.

A circular, addressed by the Minister of Agriculture, at the commencement of the present year, to the various municipalities of the province, brought replies from 154 places offering immediate remunerative employment to 15,115 emigrants, either on the farms or in different branches of industry. Great as the advantages offered are to the mere labourer, and important though he be as an element of progress to the Colony, I cannot help thinking that, were the subject liberally entertained by the provincial government, and judiciously handled at home, a higher class emigration might be induced, which, while it would, from its own superior powers, be able to advance itself far more rapidly, and with more certainty, than the lower class, would, from these very circumstances, return a greater and more permanent, as well as a more speedy benefit to the province. This would be drawn from the ranks of the small capitalist—especially the small farmer—the man struggling, more or less hopelessly, against the onward progress of agriculture, without a sufficient knowledge of the principles of his craft, or the capital necessary for its successful prosecution. These deficiencies, fatal obstacles to his future at home in an old country, would disappear in Canada, where the contents of his head and of his purse would at once assume a higher value, and would be invested with the certainty of immediate and increasing returns. He would there find a soil capable of producing every variety of agricultural produce—a climate well suited to English constitutions—a country traversed from one extremity to the other by rivers, roads, railroads, and telegraphs—exhibiting signs of prosperity and comfort everywhere, and in many places even the superfluities and luxuries of older countries. Its admirable School System, unequalled even by that of any State of the Union, would relieve the mind of the settler from one serious consideration, by assuring him of educational advantages far beyond what he has been accustomed to at home. And should he fancy that a Canadian home would leave him ignorant of what was going on in the various parts of the mighty world he had left, his doubts would soon be dispelled by showing him that the public press of Canada already numbers 247 newspapers and periodicals among its productions. Intelligence lags not there on its road, for these, with the un-

* Report of the Canadian Red River Exploring Expedition, dated Feb. 22, 1858.

equalled facilities of the telegraph, speedily broadcast the news of Europe and of their home all over the land.

The motto of Canada is, "Industry, Intelligence, and Integrity," and her emblem is the Beaver. These three qualifications are required by all who desire to make speedy and honourable progress in life, and, when possessed and exercised, they cannot fail, humanly speaking, to command success in Canada. There, there are no monopolies, exclusive privileges, or great and impassable barriers between grades of society, such as exist at home, to check or arrest the progress of the honest and industrious, but poor man. Canada is essentially "a land of hope not to be disappointed," the more especially for labour, whether skilled or unskilled—a land where there is "work and bread for all," and where the certain prospect of prosperity never fails to lessen daily toil and cheer the heart which has the courage to trust in itself, and to believe in its right and power to acquire an honourable position among mankind, with a full share of the blessings and privileges which, under Providence, justly belong to a free and honest life.

DISCUSSION.

The CHAIRMAN asked Professor Wilson whether he could give them any information about a celebrated fish of Lake Superior, "the siskawit," alluded to by Mr. Simmonds, in a paper in the third volume of the Society's *Journal*, page 40. He would read the following passage referring to it:—

"The siskawit, a fish of Lake Superior, is reported to be the fattest fish that swims either in fresh or salt water. The fishermen say that one of these fish, when hung by the tail in the hot sun of a summer's day will melt and entirely disappear except the bones. In packing about fifty barrels last season at Isle Royale, one of the fishermen made two and a half barrels of oil from the heads and leaf fat alone, without the least injury to the marketableness of the fish. Besides this leaf fat the fat or oil is disseminated in a layer of fat and a layer of lean throughout the fish. They are too fat to be eaten fresh, and are put up for market like the Lake white fish and Mackinac trout—celebrated American delicacies."

Mr. P. L. SIMMONDS said that the extract just read formed part of a paper "On some Undeveloped and Unappreciated Articles of Raw Produce from different parts of the World," which he had read before the members at the close of 1854, and for which the Society had done him the honour to award him their silver medal. It was part of a passage in which he was directing public attention to the neglected river and lake fisheries of North America, and it was known as a peculiarity of the fish of the American inland seas that they were very fat.

Before Professor Wilson replied to the Chairman's question, he (Mr. Simmonds) craved permission to make a few remarks on the very excellent paper which had just been read—a paper which, from its valuable statistics and succinct details, was calculated to do much good, not only for the promotion of colonial interests, but also in diffusing sound and authentic information at home. Unfortunately, a great deal of ignorance still prevailed among many classes in the United Kingdom respecting this, our nearest and most important emigration field. Relatively with our other possessions, Canada was making gigantic strides in progress and prosperity. He saw present his friend Sir Cusack Roney, who, from his official position and practical experience, would no doubt be able to afford much valuable recent information connected with emigration and railroad operations. And as respected railways, Professor Wilson had rather understated the number of miles open, there being now 1,653 miles in working operation. It was satisfactory to mark the present condition of Canada and its improving prospects, which were mainly owing to its extensive land and water communications, which had been so fully described. But there were other causes at work. The Americans and the British settlers were now amicably trading together on mutually advantageous terms under the Reciprocity Treaty. There were now no boundary quarrels, no fishery disputes, no hostile frontier warfare, but a beneficial through traffic was carried on up the St. Lawrence and the lakes to Chicago, and the Western States, and through Portland over the Grand Trunk Line to Canada. But Canada should be viewed not only in its isolated character, but in the relation it was likely to bear, and the influence it would exert in a Federative Union of the British North American Colonies, which would sooner or later take place, even as the union of the Australian Colonies was now being discussed by the several local legislatures. Canada, as had been well remarked, had wisely directed her chief attention to the development of her agricultural resources. These were not only the mainstay, but the sure earnest of success for a young colony. Minerals she had in abundance, the gold of the Chaudiere, the crystalline iron on the islands in Lake Nipissing, the marbles of the Belleville district, the beautiful lithographic stone extending over a tract of seventy miles, from Marmora to Lake Simcoe, the phosphate of lime in the Ottawa valley and elsewhere, and the prolific copper mines on the Canadian shores of Lake Superior, where one mass of virgin copper, weighing 160,000 lbs., had been discovered. But the period had not yet arrived for the due development of these. Labour, capital, and manufacturing works on a large scale were yet deficient. Unlike Australia, where agriculture had given place too much to mining, which partook of a speculative and gambling character, Canada had wisely looked to the products of the farm and the forest, and these furnished the staples of her prosperity. Last year we had imported 115,000 quarters of wheat from British North America. The latest returns of exports given by Professor Wilson (those for 1856), showed that the total value, adding the exports to the inland ports, amounted to about £8,000,000, averaging nearly £4 per head of the population. And the value of the imports, which, for 1856, was given at £11,000,000, was last year still larger. Much of this was, however, taken out by emigrants. Neither could the materials for constructive works, imported from England, be fairly apportioned to the population. Emigration, which had been rather slack for the two previous years, owing to the demands for enlistment during the war, was last year more active, about 21,000 souls having proceeded to the North American colonies, being an increase of between 4,000 and 5,000 over the preceding years. Most of these, as the Chairman was aware, proceeded to Canada, and although some few passed on to the States, yet the largest portion settled in the colony, and there was even an immigration from the States and lower provinces. What Canada was at present they had heard in the course of the paper read, but what she was likely to be in a few years it was difficult to tell. Looking at the extraordinary advances that had been made since 1851, in another five or six years, with improved Atlantic and internal communication—with the probable link of the submarine telegraph across the ocean—and with free grants of land, and the extended territory opened up in the Red River district, and the Ottawa valley, and the Saguenay, we should, probably, find another million added to the population. According to the report of the Commission on Crown Lands, for 1856, the total number of acres of surveyed land unsold remaining in Canada, was 6,732,220, and of unsurveyed, 168,845,455, which, added to private lands undisposed of, made a total in that part of Canada drained by the St. Lawrence and its tributaries, conjectured at 212,019,200 acres. Of this quantity, there were, in Western Canada, 830,398 surveyed, and 57,770,416 unsurveyed, and in Eastern Canada, 4,797,550 surveyed, and 112,075,039 unsurveyed. The direct trade with Canada had a large effect on shipping interests. Professor Wilson had alluded to the shipbuilding of Quebec, but there was a large amount of tonnage locally owned and employed in the Province. In 1856, 2,972 ships, registering 230,000 tons, and 1,143 steamers,

registering 119,500 tons, passed up the St. Lawrence Canals. There were in the Canadian Lakes about 230 vessels, averaging 176 tons, exclusive of small craft, and these ships were valued at half a million sterling. The timber trade with Quebec, as was well known, employed a large amount of tonnage, about 140 vessels, but the general entries of shipping from the British American Colonies last year, amounted to 2,452 ships, aggregating 1,141,476 tons. Of these, the largest number came from the St. Lawrence. When we perceived what strides the various towns and districts of Canada had made, that its colonial revenues were healthy, and its public works on a gigantic scale as compared with other British possessions—when we saw that the import trade of Montreal had doubled itself in the last ten years, and that the provincial authorities were using their utmost exertions to advance the interests of the colony at home and abroad, there could be little doubt that, all things considered, it offered a desirable home for thousands of the handy and industrious population of the United Kingdom, especially the agriculturists and artizans.

Sir CUSACK RONEY said he, in common with all present, had listened with great interest and pleasure to the paper that had been read, which contained a mass of information of the most valuable and truthful character, brought down to the latest period. With regard to the fisheries alluded to, he would state that, in the upper lakes, namely, Lakes Superior, Michigan, Huron, and Erie, very extensive fisheries were carried on. In 1856, there were from 80,000 to 100,000 barrels of fish caught, principally by Americans, and not by Canadians, which fish was salted and cured in the district, and formed a very considerable item of trade there. A very large quantity of the fish of the upper lakes was also used in a fresh state, and Detroit especially, one of the larges towns on the lakes, situated at the foot of the Lake St. Clair, consumed large quantities of it. The fisheries of the lower St. Lawrence, too, thanks to an Act passed in 1856, by the Canadian Legislature, would receive an amount of protection which they had not hitherto had. There had been for many years a vast destruction of the young fish, and great carelessness with regard to them; but now that the Act was passed for the proper protection of the fisheries, there would be an abundant supply of salmon, and by the employment of steam tugs on the St. Lawrence the fish was brought up to Quebec, and from thence it was conveyed by railway to Boston and New York, and other large cities of the United States on the eastern seaboard. The fish fetched very high prices. The Canadian Government, he was happy to say, had of late paid a good deal of attention to the fisheries of the Gulf of St. Lawrence, and had established a system of lighthouses along the coast, and also fishing stations; and he hoped that in the course of a year or two that trade would be largely developed. Professor Wilson had stated that the imports into Canada in 1856 amounted to £10,000,000, whilst the exports in the same year were only of the value of about £8,000,000. Perhaps that might appear a circumstance rather unfavourable to Canada, but the fact was, that the imports of late had been very great in consequence of the construction of railways and other public works going on there. The iron, the locomotives, and almost every description of railway plant, had been imported, and as nearly nine-tenths of the revenues of the Canadian Government consisted of customs duties, those articles, like most others, had had to pay a heavy duty. The consumption of imported articles by the actual consuming population of Canada was below £10,000,000 in the year; but, nevertheless, it was very large, amounting to £3 to £4 per head per annum, showing that almost every person in the colony was in a position to use in abundance those articles which contributed to the revenue of the country. The exports to the United States had increased in a very large measure, in his opinion very much owing to the Reciprocity Treaty, which was brought about by Lord Elgin in 1854. The development of trade between Canada and the United States had been very great in consequence, but he was sorry to add that the United States Government had recently imposed restrictions upon that trade which were likely to have an injurious effect upon Canada; but the mail which arrived the day previous brought the intelligence that Lord Napier, our ambassador at Washington, had been engaged in conferences on this subject with the American Goverment, which led to the hope that the restrictions to which he had alluded would either be removed or very considerably modified. In the comparison made by Professor Wilson between the State of Ohio and Canada there was one feature of very considerable importance, as showing the progress which Canada was making in a department of agriculture equally important to that for which the colony had hitherto been chiefly celebrated—viz., its production of wheat. He alluded to the quantity of cattle stock which they were acquiring. Ohio and Canada were in that respect about equal at the present time. In 1856, the number amounted to 900,000 head of cows and of cattle in each. In Ohio a great deal of attention was paid to the improvement of the breeds, and they had imported from this country some of our most valuable stock. It was, therefore, not to be imagined that henceforth Canada would enjoy celebrity as a wheat growing country only. They were paying great attention to other descriptions of agricultural production; and thanks to the influence of agricultural societies, which extended all over the province, and to which the government contributed liberally in the shape of prizes, they were beginning to recognise the value of the rotation of crops and those other improvements which were so important in a country like Canada. The subject of emigration had been alluded to in the paper, and, as that was a matter in which he had had some experience, he would take that opportunity to express a hope that persons unsuited for emigration to any new country would avoid going to Canada. Persons who were seeking employment as accountants, bookkeepers, clerks, and shopmen, in fact, all descriptions of persons accustomed to in-door occupations, were extremely undesirable emigrants, because they could not get employment except at a very unremunerative scale of payment. They could not compete with the native article in the new country. The younger members of families already resident there were taken into those employments, and they could afford to accept a lower rate of remuneration than those who had to support themselves entirely by their own industry. Emigrants from England seeking such employment generally failed to attain their end, and these were the people who sent home accounts discouraging emigration. Such persons had far better stay at home. Canada at present was no place for them; but to those accustomed to out-door occupations, such as farmers with small capital, labourers, and persons accustomed to use their hands and legs, to them profitable employment would be found in Canada at a rate of remuneration that was unknown in this country for that description of labour, and they might all hope to be successful if their conduct was good, and provided they were temperate. If a man were intemperate nothing could save him, for it seemed that intemperance—bad as it was everywhere—was even more destructive to human life in America than it was in this country. With regard to the great public works already executed and still progressing in Canada, he might be allowed to allude to that mighty structure, the Victoria Bridge. It would be the largest engineering work in the world. There were 24 spans with tubular girders, of the character shown in the drawings exhibited on each side of the room. These, with the exception of the centre one, were 240 feet wide. The centre span, which was intended to serve the purposes of navigation, was 330 feet wide, and there would be 60 feet between the water and the under surface of the tube. The piers were bevilled

off for the purpose of allowing the ice to pass away at its breaking up in the spring, which in that country was a formidable occurrence indeed. Within the last four or five weeks, the ice was piled up to a height nearly equal to that of the under surface of the tubular girders, but notwithstanding its unusual accumulation this season, every pier stood as solid as the rock on which it was founded. This was important to notice, inasmuch as some of the fine masonry with which the quays along the river at Montreal were built was greatly damaged and torn up by the violence of the ice. He might mention a circumstance of some importance which had occurred that day, although he could not state it as a certain fact. It had been proposed that the *Leviathan* should run for a period of years in connection with the Grand Trunk Railway of Canada, and this would be the means of carrying out emigrants to that colony and the Western States of America with an amount of comfort and attention to the wants of those persons, such as had never been experienced up to the present time. He believed the whole combination would be one that would be eminently successful. It was a curious coincidence that exactly 10,000 tons of iron were used in the construction of the *Leviathan*, and the same amount of iron would be required for the tubes of the Victoria Bridge. Allusion had been made to the progress of the electric telegraph system in Canada. He only wished that the progress made there would react a little in this country. In Canada a message of ten words, exclusive of the addresses of the sender and receiver, could be sent between Quebec and Montreal, a distance of 180 miles, for 6d., and a halfpenny for every additional word; whilst for the shortest message to Liverpool—200 miles—the charge was 4s. From Quebec to Hamilton, between 400 and 500 miles, the charge for ten words was only 1s. 6d.

Mr. G. F. WILSON, F.R.S., would say one word with reference to the latter portion of the paper, and the commentary of Sir Cusack Roney upon it. He (Mr. Wilson), in common with most other employers of labour, was often consulted by men who had saved a little money in this country, and who wished to benefit themselves and their families by emigration, but who did not see their way to do so. They were dissatisfied with their prospects at home, and they came to him for advice as to where they ought to go to. Up to the present time he had said that he believed Canada to be the right place. But this paper, he thought, gave the whole of the information that was required, and when it was remembered that it would be laid within a few days upon the tables of upwards of three hundred Mechanics' Institutions, and would be read by thousands of working men throughout the country, it was impossible to exaggerate its importance.

The CHAIRMAN said, considering that Canada was one of the finest dependencies of the crown, he thought they could not but feel indebted to Professor Wilson for placing before the public an account of the resources of that country. He was, therefore, sure that they would heartily unite with him in according their thanks to Professor Wilson for his very admirable paper.

The vote of thanks having been passed,

Professor WILSON begged to express his acknowledgments for the honour they had done him. With respect to the fisheries, those he had alluded to were not at the upper part of the St. Lawrence so much as at the lower part, and on the Gulf. He was sure that anyone who was fond of salmon-fishing, and who had read the accounts which he had seen in reference to it, would not think of going to Norway, but would start at once for the St. Lawrence. In the Saguenay and the lower St. Lawrence, he believed the salmon fishing was of the very finest description. A paper on this subject had been written by his friend Dr. Adamson, of Quebec, which afforded valuable information to those who went out upon such an expedition; and there was also a communication by Mr. Nettle, confirming all that Dr. Adamson and others had written. But there were other fisheries of greater importance than the salmon. In the St. Lawrence—in the lower part of the river—the porpoise fishery was carried on, for the purpose of furnishing oil for the lighthouses, but he believed the extent to which it had been carried on was barely sufficient for the supply required by the contract which had been entered into. In the Exhibition of 1851, a novel feature in the Canadian products was a species of leather prepared from the skin of the porpoise, for which the exhibitor, as an encouragement to pursue the matter, was rewarded with a medal, but he believed very little had been done with reference to it since.

Mr. SIMMONDS stated that it was to some extent an article of commerce in this country, and was used for shoe leather and for other purposes.

Professor WILSON added that he thought it was an article well worth attention. With regard to the salmon fisheries in that district, he was sure they would be carried out to a very large extent. He had tasted salmon in Scotland that had been sent from Vancouver's Island, and it was as fine flavoured as any he had ever eaten. With regard to the exports and imports of Canada, although the imports appeared to exceed the exports by about £2,000,000, yet this must not be considered an unfavourable sympton. He found, comparing the exports of 1856 with those of 1851, there was an increase of 150 per cent., whereas the imports had increased only 100 per cent., and at that rate the exports would soon equal the imports in amount.

A Map of Canada, showing the principal geological features of the country, will be issued with next week's number of the *Journal*.

The Secretary announced that an *Extra* Meeting would be held on Friday next, the 14th inst., when a paper by Mr. T. Baker, "On the Plan Suggested by the Government Commissioners for Disposing of the Metropolitan Sewage," would be read, and that on Wednesday next, the 19th inst., a paper by Mr. Hyde Clarke, "On the English Settlement of the Hill Regions of India," would be read.

MECHANICS' INSTITUTIONS AND MR. BAINES.

At a meeting of the Council of the Institutional Association of Lancashire and Cheshire, held in Manchester on Saturday, 24th April, 1858, it was resolved, on the motion of Mr. Councillor Rumney, and seconded by Isaac Gregory, Esq., F.R.G.S.:—

"That the thanks of the Council of the Institutional Association be presented to Edward Baines, Esq., for his admirable letter addressed to the Editor of the *Times*, entitled 'Are Mechanics' Institutes a failure or a success.'" *

"That this Council has no hesitation in assuring Mr. Baines that Mechanics' Institutions in Lancashire and Cheshire have fulfilled the chief objects of their founders, by imparting practical and useful instruction; and, as their representatives, the members of this Council unanimously express their deep obligation for his able and generous advocacy of their cause."

J. W. HUDSON, Ph.D., Chairman.
DAVID MORRIS, Hon. Secretary.

SOUTH KENSINGTON MUSEUM.

During the week ending 8th May, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 6,872; on Monday and Tuesday

* See present Vol. of *Journal*, p. 358.

(free evenings), 4,825. On the three Students' days (admission to the public 6d.), 386; one Students' evening, Wednesday, 189. Total, 12,272.

Home Correspondence.

MR. SANDERSON'S PAPER ON IRON.

SIR,—In the report of the discussion on the paper read last Wednesday, by Mr. Sanderson, "On the Manufacture of Iron," I am made to say that about seven tons of atmospheric air are blown into the furnace to make a *bar* of iron, instead of a *ton*. As the error is almost obvious, I should not have written to request its correction, but Mr. Newton's observations on the remarks I made, which the lateness of the hour caused me to pass without reply at the time, induce me to address you now. I am well acquainted with all the attempts which have been made to economise the waste heat of the gases from the blast furnaces, most of which had been failures, until I had the pleasure, about eleven years ago, to see a plan which effected this object with complete success, carried out at the Iron Works of Ystalyfera, in South Wales.

The method of doing this was contrived by Mr. Budd, the manager. The quantity of solid materials thrown into the furnaces to make one ton of cast-iron was about 5¼ tons. These works produced 40 tons per day of very strong metal, and consumed

Mineral, a clay ironstone	100 tons.
Fuel—Anthracite	80 ,,
Flux—Mountain limestone	30 ,,
Total	210 tons.

To smelt these solid materials in 24 hours, 20,736,000 cubic feet of air were blown into the furnaces, which, at a mean density of 1·22 ounces to the cubic foot, amounts to 705 tons per day. It was not attempted to ignite the heated vapours from the furnaces by a mixture of atmospheric air, which is sometimes attended with danger, but they were brought down hot from the blast furnaces, and the heat which they brought with them was directly applied to useful purposes. The steam which worked the blast-engine was raised by carrying the heated vapours under and round the boilers, and the saving of coal effected by the economical use of the gases amounted to £3,000 a year.

I subsequently advised the adoption of a similar plan at the Butterley and Codnor Park Iron Works, Derbyshire, where the Butterley Company continue to use it at both the above named works with complete success. But generally speaking those gases are wasted, and those who travel by night through the iron districts of Staffordshire and elsewhere, see the country illuminated by their flames. This is a waste of coal and of money, and as coal is one great cause of England's prosperity, it ought to be better cared for, and its waste avoided.

I am, &c.,
JOSEPH GLYNN.

28, Westbourne-park Villas, London, W.,
May 8th, 1858.

MEETINGS FOR THE ENSUING WEEK.

MON. ....Architects, 8.
United Service Inst., 8½. Capt. Blakely, "On a Method of Making Cannon."
TUES. ....Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Civil Engineers, 8.
Statistical, 8. Mr. Hendriks, "On Indian Revenues."
Pathological, 8.
WED. ....Pharmaceutical, 11 a.m. Anniversary.
Society of Arts, 8. Mr. Hyde Clarke, "On the English Settlement of the Hill Regions of India."
Microscopical, 8.
Royal Soc. Lit., 8½.
THURS. ...Philosophical Club, 5½.
Antiquaries, 8.
Chemical, 8.
Philological, 8. Anniversary.
Royal, 8½.
FRI. ....United Service Inst., 3. Lieut.-Col. F. Eardley-Wilmot, "On the Manufacture of Ordnance in the Royal Arsenal, Woolwich."
Royal Inst., 8½. Prof. T. H. Huxley, "On the Phenomena of Gemmation."
SAT. ....Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 28th April, 1858.

57 (2). Savings Banks—Account.
175. Royal Navy—Paper.
212. Army—Return.
219. British Museum—Account and Estimate.
224. Smithfield Market Site—Return.
228. Sutherland Dock Bill—Return.
55. Bills—County Management.
59. ——— Local Management.
62. ——— Chancery Amendment (amended).
63. ——— Church of England Special Services.
64. ——— Stamp Duty on Drafts.
65. ——— Exchequer Bonds (£2,000,000).
Dioceses of Canterbury, London, Winchester, and Rochester—Report of the Commissioners.

Delivered on 29th April, 1858.

180. East India (Retired Officers, &c.)—Return.
196. Woolwich Royal Military Academy—Return.
205. Grand Jury Presentments (Ireland)—Abstract of Accounts.
229. East India (Mutinies)—Copy of a Letter to the Governor-General of India.
Medical Charities (Ireland)—6th Annual Report of the Commissioners.

Delivered on 30th April, 1858.

186. Newspapers—Return.
204. Reformatory Schools—Return (a corrected Copy).
217. Soulages Collection—Return.
232. Model Barracks and Public Offices—Return.
233. Enfield Factory—Return.
239. East India (Railways)—Return.
68. Bill—Masters and Workmen.

Delivered on 1st and 3rd May, 1858.

221. East India (Mutinies)—Copies of Reports and Dispatches.
237. Battersea Park, &c.—Return.
240. Small Arms—Returns.
341. East India (Army)—Return of the Sea Kit.
243. Prideaux's Furnace Valve Door—Return.
201 (8). East India (Revenues, &c.)—Returns.
244. Roads, &c. (Scotland)—Return.
118. Local Acts (32. Durham and Cleveland Union Railway; 33. Ballymena, Ballymoney, Coleraine, and Portrush Junction Railway)—Admiralty Reports.
66. Bills—County Franchise.
70. ——— Poor Law Amendment (amended).
67. ——— Weights and Measures.
71. ——— Oaths (Lords Amendments).

Delivered on 4th May, 1858.

201 (9). East India (Revenues, &c.)—Return of the Number of Officers on the Retired List, &c.
201 (10). East India (Revenues, &c.)—Statement of Sums Subscribed to each of the Public Loans, &c.
225. Mercantile Marine Fund—Account.
226. Merchant Seamen's Fund—Account.
231. Exhibition of 1851—Accounts.
234. Examinations (Army)—Return of Names of Successful Candidates.
248. Enrolled Pensioners, &c.—Return.
249. East India (Boydell's Traction Engine)—Return.
58. Bill—Universities (Scotland).

Delivered on 5th May, 1858.

162. Civil Service Estimates—Classes 1-6.
251. East India (Civil Service)—Regulations for Examination of Candidates.
118. Local Acts (34. Stockton and Darlington Railway (North Riding Lines)—Admiralty Report.
54. Bills—Patent Law Amendment.
69. ——— Medical Profession and Medical Corporations.

Delivered on 6th May, 1858.

208. Poor Rates, &c. (Metropolitan Districts)—Return.
238. Metropolis Turnpike Roads—33nd Report of the Commissioners.
247. County Treasurers (Ireland)—Account.

Delivered on 7th May, 1858.

98 (A II.) Poor Rates and Pauperism—Return (A).
168. Increase and Diminution (Public Offices)—Abstract of Accounts.
169. Superannuations (Public Offices)—Accounts.
255. South Kensington Museum, &c.—Returns.
257. Navy (Continuance Service Men)—Return.
74. Bills—Non-Parochial Registers.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 7, 1858.]

Dated 7th April, 1858.

742. F. Haines, Lime-street—The application of manufactured india-rubber as a substitute for whalebone, steel ribs, and other like articles, to various parts of ladies' dress.

Dated 12th April, 1858.

786. J. Bailey, E. Oldfield, and S. Oddy, Salford—Imp. in machinery for driving grindstones and glazers.
788. P. Michel, Paris—An improved neck cloth or tie, means of connecting ties to collars, and an improved collar. (A com.)
790. W. Clark, 53, Chancery-lane—Imp. in the pattern surfaces or cards of Jacquard apparatus. (A com.)

Dated 13th April, 1858.

792. H. Whittles, Rochdale, J. Schofield and E. Leach, Littleborough, and J. Lord, Rochdale—Imp. in certain parts of steam engines.
796. R. A. Brooman, 166, Fleet-street—Imp. in cranes or apparatuses for raising and lowering weights. (A com.)
798. P. A. Yardin, Moorgate-street—Imp. in trusses.
800. W. E. Newton, 66, Chancery-lane—Improved means for operating railway brakes. (A com.)

Dated 14th April, 1858.

802. G. Pye, Blackburn, R. Smith, Longridge, near Preston, and B. Croasdale, Whitton, near Blackburn—Imp. in looms.
806. J. Gorham, Tunbridge, Kent—Imp. in optical instruments by the revolution of which various designs or patterns may be produced to the eye.
808. J. Gray, Uddingston, Lanark, N.B.—Imp. in ploughs.
810. E. Green, Wakefield—Imp. in implements for harrowing, pulverizing, cleaning, and breaking up land.
812. J. Knight, Woodhouse Mills, near Rochdale—Imp. in machinery or apparatus for scouring, washing, and cleansing textile fabrics.

Dated 15th April, 1858.

814. C. Davies, Duffryn, W. Jones, Caerleon, and J. Jones, Maindee, near Newport—An improved method of finishing tinned, terne, or lead plates, without the use of grease.
818. J. Meyers, Westmoreland-place, City-road—Imp. in the treatment of dark fur skins, in order to render them more highly ornamental.
820. W. E. Newton, 66, Chancery-lane—Certain imp. in boots, shoes, and other coverings for the feet. (A com.)
822. A. H. A. Durant, Conservative Club, St. James's—An improved apparatus for husking and winnowing castor (and other) seeds and berries.

Dated 16th April, 1858.

824. J. G. Hodges, Manchester—Imp. in machinery or apparatus for embroidering.
826. G. G. Brown, 25, Wickham-terrace, New-cross, Deptford—Imp. in ships' binnacles.
828. A. P. Price, Margate—Imp. in the treatment of certain zinc ores and compounds of zinc, and in the manufacture of zinc and oxide of zinc.
830. A. P. Price, Margate—Imp. in the treatment and smelting of certain argentiferous or silver ores.

Dated 17th April, 1858.

832. J. Luis, 1B, Welbeck-street, Cavendish-square—A new system of window frames for railway carriages. (A com.)
836. F. C. Gilbert, Paris (Petite Villette), Rue du Depotoir, 44 (Seine), France—A disinfecting composition to purify waterclosets, and all insalubrious places.
838. G. W. Bancroft, Bow-road—Imp. in the construction of certain parts of railway carriages, to insure safety in travelling.
840. W. Carron, Birmingham—Imp. in constructing moulds for casting nails, spikes, and bolts.
844. C. Hawker, Fishbourne, Isle of Wight—An improved manufacture of cartridge for fire-arms. (Partly a com.)
846. T. Luck, Spalding-common, Lincolnshire—Imp. in machinery for raking and seeding land.
848. J. G. Jennings, Holland-street, Blackfriars—Imp. in the construction of sewers, culverts, arches, and other similar structures, and in the manufacture of blocks of clay, pottery, and other similar wares suitable to be used in such constructions.

Dated 19th April, 1858.

850. J. Drake, junr., Huddersfield—Imp. in sewing machines.
852. W. Bullough and J. Harrison, Blackburn—Certain imp. in looms for weaving, and in machinery for winding the corn used in the manufacture of weavers' healds.
854. H. Edwards, Dalston—Imp. in trowsers or other similar articles of wearing apparel.
856. J. M. Rowan, Glasgow, and T. R. Horton, Birmingham—Imp. in steam engines and boilers.
858. J. Armstrong, 15, Nelson-street, Sunderland—Imp. in apparatus used for preserving timber.

Dated 20th April, 1858.

861. J. Whiteley, Stapleford, Nottinghamshire—An imp. in machinery for the manufacture of looped fabrics.
862. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—A nautical safe and life preserver. (A com.)
865. G. Finlayson, Gighty Burn, N.B.—Imp. in machinery or apparatus for sowing or depositing seeds in land.
866. J. B. Smith, Hockley, near Birmingham—Imp. in adjusting the position of pendent and other lamps.
867. D. Moore, Brooklyn, U.S.—An imp. in fire tongs.
868. J. Leadbetter and G. Terry, Leeds—Imp. in the manufacture of metallic trunks, and other receptacles for property.
869. J. Rawstorne, Abingdon-villas, Kensington—Improved means for stopping or retarding the progress of ships or vessels.

Dated 21st April, 1858.

870. J. Adkins, Church-street, Islington, and T. O. L. Buss, Hatton-garden—Certain imp. in ships' compasses.
871. A. Ogilvie, Denmark-street, Soho-square, and J. Richardson, 449, New Oxford-street—Imp. in apparatus for working steam engines.
872. A. Shrimpton, 112, Stanley-street, Pimlico—An imp. or imps. in the manufacture of metallic bedsteads, and other articles for sitting, lying, or reclining upon.
873. M. Ross, Gallowtreegate, Leicester—Imp. in the manufacture of frames for looking glasses, pictures, and other representations.
874. J. Copcutt, 50, St. John street, Clerkenwell—Imp. in the manufacture of gas, and in the apparatus employed therein.
875. W. H. F. Talbot, Lacock Abbey, Wiltshire—Imp. in the art of engraving.
876. J. Horsey, Greek-street—Imp. in india-rubber and other pouches, and in elastic bands or ring fastenings for pouches.
877. E. Green and E. Green, junr., Wakefield—Imp. in apparatuses for generating and superheating steam, and for heating.
878. J. J. Lane, Newgate-street—An improved arrangement of punches and dies in eyelet machines.
879. B. Parker, Clapham—Imp. in the permanent way of railways.

Dated 22nd April, 1858.

882. S. Clegg, Dover-cottage, Putney—Imp. in gas meters.
884. G. Gilmour, Massachusetts, U.S.—A telegraph cable or rope shackle.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

886. G. Gilmour, Massachusetts, U.S.—A new and useful or improved messenger shackle block.—April 22, 1858.
919. A. F. Emery, Massachusetts, U.S.—A new and useful or improved machine for sewing cloth and other material. (A com.)—April 26, 1858.
930. J. H. Bennett, 8, Vamburgh-place, Leith—An improved arrangement of safety valves for steam, gas, or any aereform or liquid body."—April 27, 1858.

WEEKLY LIST OF PATENTS SEALED.

May 7th.

2825. W. Wilson and J. J. J. Field.
2833. G. Weedon and T. T. Weedon.
2836. W. Devon.
2838. C. E. Lecointe.
2845. P. Madden.
2847. O. W. Wahl.
2851. J. Williams.
2854. F. H. F. Bertrand de Suray.
2909. J. Clarke.
2917. J. Denton.
3017. M. A. F. Mennons.
3049. J. Hoddell.
3071. J. P. Brignon.
3114. R. Oxland.
3148. W. Nunn.
470. H. Doulton.

May 11th.

2852. E. Coleman.
2858. W. J. Gifford.
2863. G. Haseltine.
2873. J. E. Hodges.
2875. J. Taylor.
2880. D. Foxwell.
119. J. Brown.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

May 3rd.

1036. R. K. Bowley.

May 4th.

1088. T. C. Eastwood and T. Whitley.
1099. G. T. Bousfield.

May 5th.

1031. J. Bowron.
1044. D. Morrison.

May 6th.

1016. J. Hands.
1019. J. H. Johnson.
1027. T. T. Lingard.
1030. J. A. Williams.
1057. J. Harris and T. Summerson.

May 7th.

1035. T. Williams and J. H. Fuller.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4083	May 1.	Port Monnaie	C. Weintraud, jun.	Offenbach.
4084	,, 1.	Cover for Jug	W. Spurrier	Birmingham.
4085	,, 7.	Cast Iron Waggon Wheel	Fossick and Hackworth	Stockton-on-Tees.
4086	,, 7.	Rabbit Trap	H. Lane	Wednesfield, near Wolverhampton.
4087	,, 8.	Roller Blind Spring	J. Apperley and Co.	Dudbridge Works, Stroudwater, Gloucestershire.

Journal of the Society of Arts.

FRIDAY, MAY 21, 1858.

NOTICE TO MEMBERS.

As the Society's financial year closes on the 31st inst., Members whose subscriptions have not yet been paid, are particularly requested to remit the amount to the Financial Officer at their earliest convenience.

Mr. Bailey Denton has forwarded to the Secretary an invitation to any Members of the Society, interested in Agricultural Drainage, to favour him with their company at Hinxworth, on Thursday, the 27th inst. Mr. Denton says:—

"Twelve months have elapsed since a large party of agriculturists interested in drainage visited Hinxworth. The works of improvement, comprehending the drainage of about 800 acres of land, and the making of above two miles of farm roads, were then on the eve of completion. The drainage was specially interesting, owing to the varied character of the works,—which comprehended the drainage of the gault clay by close parallel work, costing £6 10s. per acre,—and the drainage of mixed soils, equally wet, by occasional drainage costing only £1 10s. per acre. Careful records have been kept of the daily rainfall, the daily quantities discharged from the outlets, the reciprocating presence of water in test-holes, the barometric changes and influences, and the temperature of the soil at different depths. These have all been printed and published, and they prove conclusively the permeability of drained clay soils. The object at present aimed at, in soliciting the favour of another inspection, is to enable all persons interested in the matter to trace the effects now that the drained lands are cultivated and cropped,—and every means will be afforded visitors of judging of the pecuniary profit attending the improvements.

"The company are requested to meet at the farm-house, with *covered yard*, at 11 o'clock. The Hinxworth estate is readily approached from Biggleswade, Hitchin, and Baldock."

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty-seven Local Boards of Examiners have been formed. Returns of the Candidates who have passed the Previous Examination have been received, as follows:—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	83
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No. 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	18
Halifax, No. 1.	15
Salisbury	1
Liverpool	35
Lockwood	1
Halifax (Working Men's College), No. 2.	21
York	7
Berkhampstead	19
Bristol	11
London Domestic Mission	1
Royal Polytechnic Institution	28
Birmingham, No. 1, (Messrs. Chance's Reading Room)	2
Sheerness	1
Sheffield (People's College), No. 1	15
Sheffield (Mechanics' Institution), No. 2	3
Blackburn	5
Crosby Hall (London) Evening Classes	25
Windsor and Eton	10
Greenwich	1
Institutional Association of Lancashire and Cheshire	100
Lewes	2
Brighton	3

The number of Candidates who propose attending the Final Examinations is 337.

The total number of Candidates who have been examined by the Local Boards, is 1,108.

EXAMINATIONS.—PRIZES FOR 1858.

The following Prizes are offered to the Candidates, viz.:—

One First Prize of £5, and one Second Prize of £3 in each of the 26 subdivisions of the subjects of Examination.

No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

The Prizes will be given in money or in books, at the option of the Candidate.

The following Prizes are offered to the Local Boards, viz.:—

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than ten) bear the largest proportion to its whole number of Candidates.—One Prize of £10.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than eight) bear the largest proportion to its whole number of Candidates.—One Prize of £8.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than six) bear the largest proportion to its whole number of Candidates.—One Prize of £6.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than four) bear the largest proportion to its whole number of Candidates.—One Prize of £4.

No Local Board can receive more than one of these Prizes.

These sums may be applied by the Local Boards to the payment of the expenses of the

Examination, or otherwise, as the Board may deem best, for the promotion of the objects for which it was instituted.

EXTRA MEETING.

FRIDAY, MAY 14TH, 1858.

An Extra Meeting was held on Friday, the 14th inst., the Right Honourable Lord Ebury in the chair.

The paper read was:—

ON THE PLAN SUGGESTED BY THE GOVERNMENT COMMISSIONERS FOR DISPOSING OF THE METROPOLITAN SEWAGE.

BY T. BAKER.

Apart from the ever rolling sea of politics, there is no subject which has of late so universally engaged public attention as the disposal of the Sewage of London, and the purification of the Thames.

The advancement of the science of preventive medicine has afforded abundant evidence that the health of every individual is greatly dependent on the sanitary conditions with which the locality, and the home, may be surrounded; and the rapid ravages of cholera, introduced by the various epidemic seasons which have prevailed in this country since 1832, have rendered more palpable to the eye of the inexperienced, that which the silent devastations of typhus had long before made clear to the enlightened physician, viz.,—that very much of the disease under which the population suffer, especially among the classes at the base of the social scale, is not only preventible, but easily preventible by the most simple means,—expressed in that important word, CLEANLINESS.

This has been repeatedly insisted on by Dr. Southwood Smith, the great promoter of sanitary reform in this country, and one of the Commissioners whose report I am about to introduce to the notice of this practically important Society.

It has been remarked that ideas in England are slow in taking hold on the public mind: but as soon as it had been made generally apparent that pollution freely thrown into the fluids from which solids are formed, must, in the nature of things, create pollution in the solids *so* formed,—that poisoned air and poisoned water cannot fail to poison the animal system into which they are absorbed,—it was taken for granted by the legislature, the people, and the ratepayers, that the necessity for removing the manifestly prolific sources of misery, arising from the foul emanations of the London sewers, and the river into which they are discharged, had been demonstrated.

Now, if ideas be slow of development in the English mind, action is slower still: and so the engineering talent of this great country has been for the last ten years engaged in the discussion of various plans for getting rid of the filth which lies at our doors.

To the mind of the philanthropist it would seem, that if there be one subject more than another, on which all personal feeling may be laid aside; all professional jealousy put to sleep; and all consideration of pecuniary gain, or even scientific reputation foregone; it might be this national, all-prevading question of public health:—that the one idea kept in view by the disputants should be, what is the best mode of attaining the common object for the common weal? without a thought as to who should execute the work—or whose should be the merit of originating the chosen plan.

Surely it would be preposterous to imagine that in Britain—the birthplace of the steam-engine, the railroad, the *Leviathan*, and the electric telegraph—there can be any real practical engineering difficulty in this latter half of the nineteenth century, in thoroughly draining even the metropolis of the world, or in carrying the refuse to any distance where it may be safely disposed of. Yet we are still hammering at the plan!

EXISTING SEWERAGE AND PROPOSED PLANS.

The existing main sewers, north of the Thames, are four in number, independently of Hackney Brook, which falls into the river Lea:—1. The Ranelagh Sewer, running from Hampstead, through Kensington, to Chelsea, where it discharges its contents into the river, near the Royal Hospital. 2. The King's Scholar's Pond Sewer, also from Hampstead, a little more to the east, following the line of St. John's-wood, and the Grosvenor district, falling into the Thames at Pimlico, near Vauxhall-bridge. 3. The Fleet, from the west of Highgate, through St. Pancras, King's-cross, and Clerkenwell, to Blackfriars. 4. Walbrook Sewer, from Hornsey to the City, by the Bank and London bridge. These main sewers receive the surface and house drainage from all the districts to the east and west of them respectively. On the south side are the Effra Sewer, and some others. To relieve the Thames from these foul discharges is the problem to be solved.

A description of all the plans which have from time to time appeared for this purpose, would occupy several volumes, upwards of 150 having been submitted on one occasion. This, therefore, will not be attempted; but I propose shortly to glance at the principal schemes that have been laid down. These are—

1. Simply to intercept the sewage from falling into the Thames, near London, conveying it into, or near the sea.

2. To utilize and make profitable the sewage, which has been intercepted, by the irrigation of meadow land with the water, holding the deodorized refuse in suspension.

3. To purify the river itself, independently of the sewage.

4. Lastly, the plan which has just appeared, under the auspices of the Royal Commission, for combining the two latter objects with the general adornment of the Thames; and the relief of the streets from superabundant traffic.

INTERCEPTING MAIN SCHEME.

The great intercepting main plan, now so long before the public, with which the name of Mr. Frank Forster has usually been connected, as the proposer, was based upon the labours of Mr. Roe, and other engineers, previously in the service of the Commissioners of Sewers. This plan has been further modified by Messrs. Haywood and Bazalgette.

The matured scheme of the latter gentleman, proposed to construct three large mains at different levels, running parallel with each other, in the lines of Camden Town, the New-road, and Fleet-street, respectively, and terminating in a large reservoir at West Ham,—the sewage of the south side having its termination at Greenwich,—before reaching the final outfall at Barking Creek; from the lowest of which mains, the sewage would require to be raised by pumping. Besides the three intercepting mains on the north, and one on the south side, on the Brixton line, special provision was to be made for the western and lower southern districts; the sewage being deodorized, so as to allow the water, after the organic matter had been precipitated, to flow into the river, and the solid residuum sold for manure. For this purpose large reservoirs were to be provided, into which the sewage would require to be pumped by steam-engines, preparatory to the work of deodorization.

It is important to observe, that the principle of pumping and of deodorization, allowing the purified water to flow into the river, was here fully conceded; but this was not the first time that a system of pumping had been pro-

posed, for as early as 1848-9, Mr. Austin had recommended the formation of district stations, from which the whole of the sewage might be pumped into the suburbs for agricultural purposes.

There have not been wanting practical men of opinion, that this scheme of Mr. Austin's was feasible, and that it would have proved not only cheap in comparison with the intercepting tunnel plans, but even more effectual: and it has been thought, by some persons, that the use of a new and ugly word mainly contributed to the popular disfavour with which this plan was received. Mr. Austin had designated his proposed receptacles "sumps,"—a mining term, suggested by a celebrated geologist, who was one of the Commissioners of Sewers at that time. What was meant by "sumps?" We had never been accustomed to the sound of "sumps." A "sump," especially when connected with sewage, could only be something horrid and disgusting. Why were such nuisances to be forced upon the people? The very idea became odious! The proposition was deemed a positive injury, and the scheme was consequently hooted down, to be partially revived, as we have seen, some five years later;—with this difference, that the reservoirs were to be above, instead of underground.

There has been, from time to time, considerable discussion as to the sizes of the sewers best calculated to secure the proper drainage of houses, and, at the same time, provide for occasional storm-waters being carried off without inconvenience. This question has caused much delay, but need not be entered upon at present.

Soon after the passing of the Metropolis Local Management Act, in 1855, the general plan of interception was revived by Mr. Bazalgette, and adopted by the Metropolitan Board of Works; but, after revision by Captain Burstall, (who advised the river at Erith as the outfall, in lieu of Barking Creek), was finally rejected by H.M. First Commissioner of Public Works, who referred the plan to Capt. Galton and Messrs. Simpson and Blackwell, with special reference to the proposed outfall at Erith.

These gentlemen have reported against the outfall adopted by the Board, and recommended the construction of channels on both sides of the river, together about 47 miles in length, chiefly open, but partly covered, for the purpose of carrying the sewage to Sea Reach, near the mouth of the Thames.

The estimated cost of the intercepting sewers recommended by this plan is upwards of two milions and a quarter, and of the continuing channels to Sea Reach, upwards of three millions and a half; together about six millions,—from which no return whatever is to be looked for.

This plan of the Referees, on being submitted to the Metropolitan Board of Works, was itself referred by that body to two other engineers, who have just reported that in their opinion the proposed works would cost full eleven millions;—and suggested other modifications in the scheme of Mr. Bazalgette.

Utilisation of the Sewage.

Among the proposals for turning the sewage of London to a profitable use, in addition to those already mentioned, a scheme, propounded several years ago by Mr. McLean, for taking such of the contents of the sewers as might not be purchased for manure from West Ham into the river Crouch, near to the sea, was, about two years since, supported by Sir Morton Peto, who offered to find the necessary capital, and to execute the works, on condition that 4 per cent. per annum on £600,000 were guaranteed to him by Government, he being at liberty to dispose of the sewage at any points of its course for distribution over the lands;—and it was calculated that in a short time, though, perhaps, not at first, very little, if any, of this manure would be allowed to reach the Crouch.

Meantime, so much difficulty had been felt, not only in London, but in different towns throughout the country, as to the increased pollution of rivers where systematic drainage works had been carried out, that soon after this proposition of Sir Morton Peto's had been made, the Government appointed a Royal Commission to examine whether the assertions of the economists were well founded, viz.,—that town sewage is valuable as manure, and that, therefore, to spend an enormous sum to throw it away would be committing a double waste.

The Engineering Referees appointed by the First Commissioner of Works, were instructed to put themselves in communication with the Sewage Commissioners, but the former having advanced their inquiries on the plan, while the latter body had scarcely commenced its labours, the Engineers thought fit to offer their own opinion against any attempt to turn the metropolitan sewage to account, whilst the Commissioners, who have now presented a preliminary report, not only decide that town sewage is valuable; is capable of being deodorized without nuisance or injury to health; and ought, therefore, to be used instead of being thrown away; but offer a new plan for dealing with the sewage of London.

In this preliminary report we are not furnished with an estimate of the probable sum which would be realized from the sale of the metropolitan sewage as manure,—details being promised in a future report,—but the general conclusions now given, with respect to the whole subject of the disposal of the sewage of towns, are as follows:—

"1st. That the increasing pollution of the rivers and streams of the country is an evil of national importance, which urgently demands the application of remedial measures; that the discharge of sewage and of the noxious refuse of factories into them is a source of nuisance and danger to health; that it acts injuriously not only on the locality where it occurs, but also on the population of the districts through which the polluted rivers flow; that it poisons the water, which in many cases forms the sole supply of the population for all purposes, including drinking; that it destroys the fish; and generally that it impairs the value and the natural advantages derived from rivers and streams of water.

"2nd. That this evil has largely increased with the growing cleanliness and internal improvements of towns as regards water supply and drainage; that its increase will continue to be in direct proportion to such improvements; and that as these improvements are yet very partial, the nuisance of sewage, already very sensibly felt, is extremely slight as compared to what it will become when sewage and drainage works have been carried into full effect.

"3rd. That in many towns measures for improved water supply and drainage are retarded, from the difficulties of disposing of the increased sewage which results from them; that the law which regulates the rights of outfall is in an anomalous and undefined condition; that judicial decisions of a conflicting character have been arrived at in different instances; and that consequently the authorities of towns have constantly before them the fear of harassing litigation.

"4th. That the methods which have been adopted with the view of dealing with sewage are of two kinds; the one being the application of the whole sewage to land; and the other, that of treating it by chemical processes, to separate its most offensive portions; that the direct application of sewage to land favourably situated, if judiciously carried out, and confined to a suitable area exclusively grass, is profitable to the person so employing it; that where the conditions are unfavourable, a small payment on the part of the local authorities will restore the balance.

"5th. That this method of sewage application, conducted with moderate care, is not productive of nuisance or injury to health.

"6th. That when circumstances prevent the disposal of sewage by direct application to land, the processes of precipitation will greatly ameliorate, and practically obviate the evils of sewage outfalls, especially where there are large rivers for the discharge of the liquid; that such

methods of treating sewage do not retain more than a comparatively small portion of the fertilizing matter, and that although in some cases the sale of the manure may repay the cost of production, they are not likely to be successful as private speculations.

"7th. That considered merely as the means of mitigating a nuisance, these precipitating processes are satisfactory; that the cost of them in any case is such as town populations may reasonably be called upon to meet; that the necessary works need not, if properly conducted, be a source of nuisance; and that, by modifications of the existing methods, even the slightest risk of nuisance may be entirely obviated.

"8th. That the employment of the one or other method of disposing of sewage, or of both conjoined, must depend upon locality, levels, markets, and a variety of other circumstances, and that the case of each town must be considered upon its own peculiarities.

"9th. That there is good ground for believing that the methods yet proposed for dealing with sewage are not the best that can be devised, and that further investigation will probably result in the discovery of processes more thoroughly equal to the suppression of the nuisance, and at the same time calculated to give more valuable products.

"10th. That the magnitude of a town presents no real difficulty to the effectual treatment of its sewage, provided it be considered as a collection of smaller towns."

I believe that it has been proved in several of our cavalry barracks, and by dairymen, that the best disinfectant for stables, cowsheds, and piggeries, at the same time greatly improving the health of the cattle where used, is a powder manufactured by Mr. McDougal, of Manchester, a paper on which was recently discussed by this Society. If this powder has not yet been brought under the notice of the Commissioners, it may be worth a trial, if not for the precipitation of the sewage, at least for the defecation of the solid portions of the manure, of which it much increases the value by fixing the ammonia.

Purification of the Thames.

With regard to the purification of the River Thames, independently of the continued discharge of sewage into the stream, a valuable report, by Mr. Goldsworthy Gurney, was printed, by order of the House of Commons, in December last. In this report it was shown that the solid matters of sewage, being considerably heavier than water, sink at the rate of about a foot per minute in still water or slow currents—and that they will also precipitate in stronger currents, even up to the rate of 170 feet per minute; but, when the current runs above this rate, the sewage is kept in a state of mechanical admixture with the water. Consequently, sewage will deposit at all times of the tide along the banks, where the current is always sufficiently slack; although, in the middle of the stream, while the tide is running full, such portions as have not already sunk will continue suspended in a mixed state. When the tide is not running it sinks in all parts. It follows that immense deposits of sewage and foul matter are retained in the mud banks along shore—the accumulations of centuries, and that these deposits can never be removed by the tidal influence. Eddies along shore, produced by the opposition of the freshet, down the river to the flow of the tide, and running upwards at the ebb, would prevent this, even were the foul matter in a state of admixture with the water.

"The tide," says Mr. Gurney, "off the terrace at the Houses of Parliament, runs at an average rate of from three to four miles per hour in the middle of the stream; towards the sides its rate is considerably less; within eight yards of the shore it never runs at a rate exceeding 78 feet per minute; nearer to the shore it generally falls into a slack—at from two to four yards off the shore, the tide is either still or takes an opposite direction; when the stream runs up, the eddies run down; when the stream runs down, the eddies run up; as is the case in all tidal rivers. Between these currents the natural water brattice is formed, with a series of recesses, or little cesspools running along shore." Mr. Gurney explains that the water brattice is the still line which divides two retrograde or opposite parallel currents. "Within these brattices a large quantity of sewage is always precipitated and permanently retained. On looking along the river, two black lines may generally be seen stretching along the sides; these black lines are the series of cesspools just adverted to, filled with sewage."

As a natural consequence, it was found, by careful experiment, that the water at the sides was at all times more than five times as foul as that taken from the middle of the stream.

Again, Mr. Gurney says, "in the river, at high water, about the turn of tide, there is a notable period in which the water is still, or nearly so, for about 10 or 20 minutes. The sewage will then fall about the rate of a foot per minute, and if it continues for 10 or 20 minutes, the sewage will fall as many feet; at this depth it will reach the bottom in many places. After the tide has turned, and the slow current commenced, the sewage will still continue to sink in the slack, retrogrades, and eddies along shore, where it will remain until the turn of tide. A large portion on the flow will be stirred up and carried back again by the upcast."

He proceeds to point out that the quantity of foul deposit retained in the Thames is nearly constant, being governed by the size of the slack and retrograde currents; that the sewage, if discharged into the river at all, no matter how far down, would be brought back by the upcast; and that if the retrograde currents be not destroyed, it will be retained in the stream in large quantities. But if the retrogrades are destroyed, the sewage will not be so retained, as in all tidal rivers where there is no room at the sides for slacks or retrogrades to form there is no deposit; and he recommends—

"That all the retrogrades and brattice cesspools be destroyed.

"That all obstructions to a uniform flow of the river, at low water, be removed.

"That the projections along shore be rounded off, and the hollows filled up.

"That the serrated edges of the river at low water be made plain, and continued along the whole line of low water mark.

"That the width of the whole water-way, when the tide is at its lowest ebb, be not more than 140 yards from side to side; so that the river may run, not only in a uniform current, but at a rate of not less than 225 feet per minute."

He adds, that by these means, "the navigation of the river would be improved."

Mr. Gurney observes, in conclusion, "that the above recommendations do not interfere with any vested interests, or affect the navigation of the river, [while the works are in progress], and, therefore, may be carried out at once."

Plan of the Royal Commissioners.

We arrive at length at the plan just promulgated by the Royal Commissioners, the novelty of which consists in turning to account facilities afforded by one necessary work for executing a second, and not less important undertaking;—thus concentrating into one grand scheme various propositions which, separately, could not have been carried into operation without very much greater difficulty and expense; whilst it may also lay claim to that candour which is willing to adopt whatever of good may be found in the plans which have from time to time been launched, in attempting the solution of that most desirable consummation, the effectual drainage of London, in combination with the effectual purification of the Thames.

The Commissioners, whose preliminary report is dated 26th March, 1858, propose to collect the sewage in intercepting reservoirs, constructed at the present outfalls along the river banks, and these reservoirs, being chambers formed in the embankment walls about to be described, everything in connection with them will be quite out of sight. Each receptacle will continue to form, as it were, the outfall of a separate town, at which the work of deodorization, pumping, &c., will be carried on independently of the others.

The present sewers, which, small and large, extend to above a thousand miles in length, will remain undisturbed; only that a few intersecting mains for the higher, and collecting mains for the lower, levels, will be required for conducting the sewage into the reservoirs. The purified water, all organic matter having been first precipitated by the most improved chemical means, will be allowed to flow into the river—as proposed by various persons, and amongst others by Messrs. Haywood and Bazalgette, in 1852, for the western district—and the thick slimy residuum, pumped either into the rural suburbs for manure, or to the sea, whither it may even be removed daily in barges, should the demands of the gardeners and farmers be unequal to the supply. In this manner the questions of drainage, and application of the sewage to agricultural uses, are disposed of: and the Commissioners show that there can be no foundation for any apprehension of nuisance arising from the sewage, or the works.

In corroboration of this opinion there is appended to the report of the Engineers recently consulted by the Metropolitan Board of Works, and published almost simultaneously with the report of the Royal Commissioners, a letter from Dr. Letheby, the City Medical Officer of Health, to which my attention has been called since this paper was first written. Dr. Letheby says:—"By the action of lime on sewage, the sulphuretted hydrogen and carbonic acid are fixed, as well as a small portion of the soluble organic matter, forming a precipitate, which contains carbonate of lime and the insoluble matters of the sewage. This precipitate is in a flocculent form, and it rapidly subsides, leaving a clear liquor, which is nearly deprived of odour.

"I am quite sure that the process of defecating the sewage of London, by means of lime, may be effected with advantage and perfect safety, and that the discharge of the clear sewage water into the Thames will not be a source of danger or discomfort to the public."

On the plan of the Royal Commissioners, the areas for constructing the large reservoirs are to be provided by the adoption of a modification of Mr. Page's scheme for embanking the Thames, recommended by the Metropolitan Improvement Commissioners in their report of 1844. This will also secure the object of Mr. Gurney, who confined his attention to the improvement of the river bed, as also that of Mr. Walker, who proposed a solid embankment, to a uniform line, having recesses for the barges.

Mr. Page's proposal for the river embankment, as is well known, is to construct advanced terraces on each side, from Chelsea nearly to London Bridge, so as to confine the stream to an almost uniform width—about the same as it is at present between London and Southwark Bridges. These terraces will be from 6 to 10 feet above high water mark, and will communicate with the existing banks by roadways, and from some of the bridges underneath which the terraces will pass. Where there are no wharfs the spaces between the terraces and the shore will be filled in solid; affording space for gardens, as at Chelsea, Whitehall, Somerset-house, and the Temple.

The plan of this embankment is appended to the Report of the Royal Commissioners, who propose that the reservoirs for collecting and purifying the sewage shall be formed by internal chambers, 22 feet wide, in the terrace embankments themselves, so that no land will have to be purchased. Between the embankment walls and the wharfs there will be permanent docks or basins,—which may be entered both at half and full tide,—so that the accommodation at the wharfs will be much increased, whilst the narrowing of the river channel within the straight uninterrupted walls will considerably improve the navigation; and, lastly, the width of the terraces being 56 feet, facility will be afforded for the construction of carriage ways and railroads along the whole line, connecting, as it were, every suburb of the Metropolis at one common centre. There will be a few reservoirs placed in portions of solid embankment, at such outfalls as may also be necessary above Chelsea, and below London-bridge; besides similar works at the mouth of Hackney Brook.

The very moderate estimate for this stupendous undertaking, including the embankments and roads on both sides of the river, and all the necessary reservoirs and apparatus, is three millions and a quarter—being little more than half the outlay required for the scheme of the three Referees, for drainage alone, according to their own calculation, and not one-third on the estimate of their critics.

The importance of this work is admitted by the Engineers of the Metropolitan Board of Works, who in addition to their recent modification of Mr. Bazalgette's drainage plan (6th April, 1858), recommend the embankment of the Thames as a separate undertaking necessary for the purification of the stream; this advice being founded upon the opinion of Dr. Letheby, who writes, (15th March, 1858) "As to the proposition for embanking the Thames and narrowing the channel, so as to scour the bed, I believe it to be the most effective means of improving the condition of the river, and of protecting the public health: for the removal of the offensive mud, and the submerging of the river's banks, are, in my opinion, the most important of all considerations."

This comprehensive scheme of the Royal Commissioners for intercepting and disposing of the London sewage possesses one great advantage over all the other drainage plans, viz., that the ratepayers will not only have, but will *see* that they have something for their money; something, too, far superior to the improvements, grand as they are, now going on in Paris by direction of the French Emperor. Moreover, it may be urged that Government might fairly be expected to contribute towards the Thames embankment, this being a truly national work,—and pronounced absolutely necessary for the improvement of the river navigation, as well as the sanitive preservation of our great legislative bodies, by Mr. Gurney,—who is supported in his opinion by Messrs. Walker and Page, by the engineers of the Metropolitan Board of Works, and by Dr. Letheby.

Such is the plan suggested by the Royal Commissioners for disposing of the Metropolitan Sewage: a project which seemed to me to be so important, in a national point of view, as to demand the immediate attention of the scientific and philanthropic men who are accustomed to congregate in this hall; and the Council of the Society, with the urbanity for which they are distinguished, as soon as the matter was named to them, set apart this special night for the discussion.

It may, I think, be safely affirmed that no vested interests will be injuriously affected by the proposed river embankment. Seeing, however, the great propensity which exists in this country for setting up private against public interests, and the leaning of juries towards the individual against the mass,—whereby selfish men are often tempted to prefer claims to be exorbitantly compensated for temporary inconvenience, at the public expense,—it may be well to obtain power of purchasing any property along the line of works, relative to which differences may arise, the price to be settled by arbitration; the expense of such arbitration to be borne between the parties in an inverse proportion to the nearness of the award to the sums offered, and claimed, respectively. It is well-known that men will endure im-

mense temporary inconvenience and suspension of business in carrying out private improvements, for prospective advantages,—whilst, the moment that equal private advantage is promised by a public improvement, at much smaller present sacrifice to them, they will demand enormous compensation for alleged loss.

Let us, however, indulge in the hope that, if the plan now proposed by the Commissioners be found by impartial practical men to be effectual for all the purposes proposed,—and it is difficult to perceive any valid objection to it,—and, at the same time, calculated largely to contribute towards the convenience and adornment of this great metropolis, and, above all, to the health and enjoyment of its millions of inhabitants;—let us, I say, hope that no spirit of petty jealousy on the part of professional men; no mean parsimony on the part of financiers or ratepayers; no grasping avarice on the part of vested interests;—will be allowed to interfere with its cheerful, speedy, and thorough execution.

DISCUSSION.

The Chairman said Mr. Baker had commenced his paper with the remark that, apart from the ever rolling sea of politics, the subject which they were now met to discuss engaged, perhaps, the largest share of public attention and interest. He felt the truth of that remark, and was himself an illustration of it, for he had that evening quitted an unusually interesting debate in the House of Lords for the purpose of attending this meeting. It was true that the pleasure which the meeting afforded him was one inducement, but the great reason was the interest which he himself felt in the subject before them. He would first touch upon the steps that had been previously taken in reference to this matter, and then offer a remark or two upon the proposal which had recently been put forward by the Royal Commissioners, and which had been detailed by Mr. Baker. Now, the Metropolitan Board of Works had been, he believed, a good deal blamed for not having as yet proposed a scheme which was satisfactory, for the purpose of disposing of the sewage of the metropolis. Indeed, Mr. Baker himself had blamed—he would not say the Metropolitan Board only—but all parties alike, in that they had arrived at the year 1858 and were still "hammering at" the measure which, eventually he hoped would be completely hammered out. He (the Chairman) did not think that blame was justly deserved by anybody—certainly not by the Metropolitan Board of Works. We ought to recollect the position they were in. What did this Report of the Royal Commissioners say on the subject? It was a most able Report. He never read a Report with more satisfaction; it was liberal, and not tainted with prejudices of any kind. Wherever difficulties arose a fair confession of those difficulties was made; and where they could do so they made suggestions by which these difficulties might be overcome. What did the Royal Commissioners tell them? They told them this most important fact, that these difficulties had only come upon us of late years. All that the old Commissioners of Sewers had to do, was not to take away the refuse of London and dispose of it, but to prevent people from draining into the sewers. It was only in recent times that we had had to deal with the difficulties with which we were now surrounded. Therefore no board or boards were to be blamed if they could not all at once provide a plan to meet the increasing necessities of the case. He was not himself a member of the Metropolitan Board, although he had had a considerable share in the preparation of the act, but it must be remembered that this board was preceded by two or three other boards, and he could not say that what they proposed was more feasible than that which had been put forward since. He must say that the plan of expending several millions of money in carrying the sewage away to be thrown into the sea was a satire upon the age in which we lived, and therefore he would not touch upon that subject, for he did not think it would for a moment enter into the calculation of those who listened to him. He would briefly proceed to notice the plan proposed by the Royal Commissioners. There was one important subject which had been touched upon in the report, namely, the state of pollution at which rivers generally had arrived—(not the Thames only)—partly from the sewage and partly from the residuum of manufactures thrown into the water. Now, Sir Benjamin Hall and himself had strenuously endeavoured to introduce into the Removal of Nuisances Act a clause to prohibit persons engaged in manufactures from disposing of the residuum by discharging it into rivers, unless they had used the best known means to prevent such residuum from polluting the water, but owing to the influence of powerful interests in the legislature they were defeated, and were compelled, after several divisions, to give up the clause. It was remarkable how much pleasure and exercise was afforded the poorer classes by the banks of a river. There was always something of interest going on—and if they went down the Thames on a fine day they would find the little public nooks leading down to the river's edge crowded with human beings. This was one reason why the plan before them, involving as it did the improvement of the river, strongly recommended itself to his mind. Then again, they had to deal with the continually increasing traffic of the streets of London, which was becoming almost intolerable. The amount of the traffic was so great, and the streets was so encumbered by those immense vans which rapidly injured the roadway, besides obstructing the thoroughfares, that this had a serious effect upon the amount demanded from the ratepayers for repairs; and he thought that, although they would have to pay heavily for the embankment of the Thames, the relief thus afforded to the traffic would effect an important saving in the rates, which should not be lost sight of. At the same time we were bound manfully and honourably to look the difficulties of the scheme in the face, and to note the disadvantages as well as the advantages. The disadvantage which principally struck him was this. They had in this scheme to deal with the difficult subject of the sewers themselves, which it was proposed to place within this embankment, and it was not stated whether the three and a-half millions estimated cost included these sewage works. There could be no doubt that a very large amount of valuable fertilising material could be precipitated by chemical means, and that as far as that went the problem was solved. If they could get the sludge separated from the water, the latter might be safely discharged into the river without being productive of any evil at all, for, even in the present day, it had not been proved that the discharge of sewage into the river had had any seriously bad effect upon the health of persons living in houses where proper attention was paid to ventilation. It was only the very poorest classes dwelling in wretched and ill-ventilated tenements, who suffered from the malaria generated from the deleterious substances discharged into the river. The great difficulty was, how to deal with the sludge. Two or three different plans might be suggested. They might follow that adopted at Leicester and other places. It might be desiccated and disposed of as manure. This was, he thought, the simplest process of all, but, he could not say whether or not it was wholly unattended with nuisance. The Commissioners had stated that the sewage might be taken away in barges, or pumped up to certain districts where market gardeners and others would like to have it; but they had not given any estimate of the expense of steam power, or other necessary details. It was exceedingly necessary for those to whom the carrying out of this measure would be entrusted, to consider what would be the effect upon the river itself of confining it within new and narrower banks. Serious evils had resulted at Chester, a city with which he had formerly been closely connected. The embankment of the

river there was undertaken, and most favourable effects had been expected from it, but the result had been that the mouth of the river had silted up to such an extent, that now they were not able to get ships up to Chester except at very high tides. If the flow of the tide was impeded and a smaller amount of water was carried up the channel, the scour would be diminished to an equal extent. This would, however, be to some extent modified in the plan proposed, by having arches to admit the water into the docks where the barges could remain, and, therefore, perhaps what he had said was scarcely an argument against the plan of the Royal Commissoners. The sewage had become a serious evil in the present day, and in process of time would become still greater, and would be attended with more danger, and the safety of the population was a matter to be most carefully considered. It was his great desire to see places of healthful recreation provided for the toiling thousands pent up in cities, and he should indeed regard it as a halcyon day when the working people of this great metropolis should have abundant opportunity for open air exercise and recreation, and to promote that end he would do all in his power. Although he was a member of this Society, he was prevented from attending the meetings as often as he could desire, but he thought that the managers of it deserved well at the hands of their fellow countrymen, for having afforded facilities for the discussion of this interesting and highly important subject.

Mr. Lawrence Palk, M.P., said this was a question in which he had taken considerable interest, and perhaps he might be allowed to say a word or two upon it. He had read the report which had been so much alluded to that evening, and he must say a more excellent report he had never perused. He did not mean to say that with regard to some of the conclusions there might not be some doubt, but upon the whole he thought it had put the question of getting rid of the sewage of towns upon a more practical footing than it had ever been on before. The principle which predominated in that report was that of getting rid of the liquid sewage of towns by a system of irrigation of meadows, as practised with great success in the neighbourhood of Edinburgh, but there, as they would perceive by the report, complaint was made that a nuisance occasionally arose from the deposit of the sewage in the open ditches. The system of irrigation was by no means new in Devonshire, and, in fact, was almost peculiar to that county. They had had for many years a system of irrigating the meadows there by the springs that rose from the sides of the hills, the result of which, as regarded the crops, had been found to be extremely beneficial. The hon. gentlemen proceeded to read a letter which he had received from Mr. Campbell, of Rugby, detailing the results of some experiments he had made in irrigating with sewage water. Judging from the conclusions arrived at by the writer of that letter, it would seem that the irrigation of land with sewage might be carried on with profit to the town and with great benefit to the agricultural districts. The other leading feature of the report of the Royal Commissioners was the chemical deodorisation of the sewage by the means with which they were already acquainted. Being very anxious to test that plan by actual experience, he went to Leicester and witnessed the entire process under Mr. Wickstead's system,* and he could speak with the greatest confidence of its perfect success. He saw the process through all its stages, and he did not notice any particularly offensive smell; indeed the smell was not of a character to satisfy the critical senses of the agriculturists of the district in that respect. He was told that the lime used for precipitating the solid matters acted injuriously upon the fertilising properties of the manure, and that unless some means of fixing the ammonia were adopted, it would not be found of sufficient value to be really profitable. He thought this was a question which was well worthy the attention not only of gentlemen connected with large towns, but also of those who, like himself, were connected with the agricultural interests of the country. If they looked to the increasing value of guano, and the difficulty there was in obtaining it pure, he thought it was important that science should be brought to bear, in order to retain for the use of the agricultural districts that which was the bane of large towns, but which was of such extreme value to the farmer. He therefore hoped that those in whose hands this great question was, would consider well before they sanctioned any plan which should pour into the sea as useless a material which might be made to be a great blessing to the country at large.

Mr. Haywood said they were called together to discuss the plans proposed by the Royal Commissioners for disposing of the sewage of the metropolis. Before entering upon those plans, he would look for a moment at the conclusions which the Commissioners had arrived at, and which were stated in their report, and quoted in Mr. Baker's paper. That commission was appointed in January, 1857, and, after sitting for 12 or 15 months, it had arrived at nine certainly very satisfactory conclusions, and these conclusions had, doubtless, acquired considerable additional importance from having received the assent of that commission; but every one of them had been arrived at before by practical men who had carefully considered the question. There was not a single point of novelty in any one of these nine conclusions. The most important of them, perhaps, was the fourth, in which the Commissioners admitted that, after examining nearly all the places in the country where irrigation by sewage water was practised, their opinion was that, excepting under very favourable circumstances, it would not pay. That was a most important point. There was no novelty in it, but it would derive greater force by being promulgated through the authority of this blue book. The next conclusion was also an important one, as bearing upon the subsequent scheme, viz., that works for precipitating sewage matter might be erected in the vicinity of towns without inconvenience to the inhabitants; with that he quite agreed. The tenth conclusion required some explanation, as at present it was put in a very doubtful shape. With regard to the scheme itself, it was necessary that they should have it really before them before they could discuss it, but the report merely gave an outline—an idea of a scheme. It told them, in the first place, that sewage might be dealt with without fear of harm to the inhabitants of the city, and, secondly, that if the Thames embankment were carried out, the sewage works could be made upon that embankment. That, in fact, comprised the whole of the scheme now propounded, and, as such, he was quite unable to discuss it. There was an entire absence of all detail by which the probable cost might be estimated. They were quite left in the dark as to the number of the works, and as to their situation, because, he maintained, that there must be works established far beyond the line of embankment proposed in this scheme. He thought it was a fallacy to think of treating this question of the embankment of the Thames unless they were prepared to treat also of the question of compensating the persons who held property on the Thames. Parliament would never entertain a scheme, apart from compensation to the owners of the property which would be affected by the plan; and this would form a fearful item in the cost of the embankment. In the paper of Mr. Baker comparison had been made between the cost of this scheme of the Royal Commissioners and that proposed by Mr. Bazalgette, and partly by himself, which would be considerably increased if the suggestions of the government referees were to be attended to. It was useless to attempt to make a comparison between a scheme of which they had the whole of the details, and that of which they possessed none; but he must say this, that in every plan for the intercepting of the sewage, the

* See *Journal*, Vol. V., page 49.

question of the improvement of the arterial drainage must form an integral part. If this plan of the Commission was merely a question of taking up the sewage at its outlet, the estimates would then be formed upon entirely different premises, and no fair comparison could be made between them. The scheme of the Royal Commissioners was at present but a mere shadow, and as yet nothing had been put forward which could enable practical men to judge of its merits or demerits.

Dr. BARNES observed, that although the author had appealed in his paper to the "enlightened physician," he (Dr. Barnes) could not but feel that throughout the main-drainage controversy the medical propositions, which formed the very basis of all drainage schemes, had been taken for granted. The evidence of medical observers, who alone were competent to solve the fundamental question as to the effect of the Thames upon the health of the metropolis, had never been taken. The engineer and the chemist could not properly be called upon to produce plans and remedy an evil before the evil was proved to exist. He asked where were the proofs of the prejudicial influence of the Thames upon health? The opinions of Mr. Burk, of Dr. McWilliam—he might say of all those who had enjoyed special opportunities of observing the sanitary relations of the Thames, coincided with his own—that the Thames population was remarkably healthy. Fever and diarrhœa were less prevalent amongst those living near the river than amongst those at a distance from it. He must also insist that the principle of concentrating sewage in gigantic drains was radically wrong. The right principle was the very opposite one—to subdivide the sewage as much as possible. Mr. Haywood had shown the insurmountable difficulties in ventilating the sewers even in their present comparative simplicity, and surely this difficulty would be enormously increased by collecting the sewage into main-drains. We should be subject to the reflux of sewage gases into our houses with tenfold greater virulence. Mr. Goldsworthy Gurney's report had been much referred to, but he (Dr. Barnes) felt bound to point out that it displayed such misapprehension of some of the first principles of chemistry, that it ought to be read with caution. His opinion that sewage gases were propagated solely by virtue of the law of the diffusion of gases was directly at variance with observation. The sewage gases escaped into the streets and houses under the immediate action of currents, the force of which was demonstrable by the anemometer. In referring to the scheme of the Royal Commissioners, Dr. Barnes said it had been truly pointed out by Mr. Haywood that no complete plan had been presented by them. He was at first much disposed to agree with that report, but the difficulties urged by Lord Ebury and Mr. Haywood, now satisfied him that this report only added another argument to those he had been urging for some time past, in favour of a full and open inquiry into the whole subject, including the fundamental principles which had been overlooked altogether. At any rate, before committing the ratepayers to the execution of the plan as a whole, he advised that it should be adopted at first partially and experimentally, taking only one large sewer at a time.

Mr. HOLLAND felt with Mr. Haywood, that the plan of the Royal Commissioners was a mere sketch, and therefore we were not in a condition to do more than discuss the idea which had been propounded. Mr. Haywood had omitted to notice one very important feature in the question. The report of the Royal Commissioners started with the assumption, that the embankment of the Thames was a good thing *per se*, without any reference to the sewage question at all. If they assumed that this ought to be carried out on its own account, and was worth its cost, then Mr. Haywood's argument about that part of the cost did not hold good. He had no doubt the embankment would be a matter of enormous expense, and he was sceptical as to whether the benefits resulting from it would be equal to the cost it would involve; but assuming this to be the case, then he thought no one could doubt that, so far as the disposal of the sewage went, this plan—if effectual—would be the cheapest that could be adopted. With regard to the question of disposing of the sewage profitably, there were various opinions upon that. He took it for granted that the sewage of London was too valuable to be thrown away; but, at the same time, he thought the expense of conducting it to where it could be brought to profitable use would be very great, and it would be difficult to persuade the public that it was worth while to incur such an expense under the idea of eventual profit. If we lived under an enlightened despotism, no doubt the thing would be carried out; but unfortunately, as regarded this question—though fortunately in other respects—the state of things in this country was very different, and therefore we must make the best we could of the matter. His impression was that they would lose so much time in persuading the public into the idea of conducting the sewage where it could be brought into profitable use, that it might be better to give this up altogether as regards London. What he disliked in this report of the Royal Commissioners was, that it seemed to imply a doubt, probably not intended, upon the profitable application of sewage matter in places where the objections which applied to the metropolis did not hold good. In most of the towns of England the sewage could be conveyed upon the land with very little expense, but London, lying at about the level of the sea, with an enormous amount of occupied land round it, presented a case of very great difficulty. The rendering of the sewage inoffensive was an easy thing enough, and was carried out perfectly at Leicester. He did not, however, agree with the hon. gentleman (Mr. Palk) that the process was entirely free from all offensive smell. At the same time the odour was not of an intolerable character, and he believed this objection might be still farther modified, if not entirely done away with. He had been told that there was some invention by which the fertilising matters might be entirely precipitated from the sewage. He had heard this as much as twenty years ago, and was told of it again within the last few weeks, but he was still, as he had ever been, sceptical on the point. He did not believe this could be done; if so, the sewage question would be at once disposed of, and all further discussion would be needless.

Mr. FREDERICK DOULTON said they were discussing a question with respect to which they had in fact no data on which to come to a conclusion. They had no tangible plan before them to discuss, but merely the outline of a plan. He thought good would result from this report, although upon the question of the disposal of the sewage the Royal Commissioners had scarcely gone further than to condemn the proceedings of former Commissioners of Sewers and Boards of Works as radically wrong. That was the conclusion they had arrived at, and he thought if they had convinced the world at large of the difficulty and uncertainty which attached to the whole question, they had done great good, although they had not put forth a plan in sufficient detail for discussion. There seemed to be an uncertainty about this which did not attach to any other question. One set of engineers had estimated the cost at one million, others equally eminent had put it down at three millions and a-half, whilst others had mentioned eleven millions. As a member of the Board of Works he did not regret, but rejoiced at the delay that had taken place on this question, and he believed that good would arise if they were not hurried into a decision on so important a subject. In his opinion, further inquiry was necessary, not only as to the necessity of diverting the sewage from the Thames, but also upon the question of the large intercepting sewers proposed. They had a very striking illustration of what might be looked for in the carrying out of the larger scheme, in the Victoria-street sewer, which was to cost £4,000 or £5,000, but which had reached, he believed, £200,000.

When they recollected that the strata through which these proposed sewers must pass were of the same character as those in which the Victoria-street sewer was formed, they had some glimpse of the difficulty and expense that might be incurred.

Mr. PITTARD said, as the Medical Officer of the London Docks, he felt great interest in the question under discussion. The water in those docks having become extremely offensive in hot weather, he sought means to effect a remedy, and with that view he paid a visit to the Tottenham Sewage Works, and witnessed the process of deodorisation carried on there. The water that was discharged had the appearance of great purity, but having had the curiosity to preserve a little of it, he found after a few days its odour became intolerable, which, he thought, proved that the impurities, although temporarily suppressed, had not been really removed. Mr. Pittard made some remarks upon the present polluted state of the Thames, which was perceptible to all who made the passage of the river; and the odour being similar to that emitted from the gully holes of the sewers, he thought there could be no doubt as to its deleterious influence on the health of the population.

Mr. ROBERT RAWLINSON said, although the report of the Royal Commissioners had been termed an outline, or sketch of a plan, this was no proof that a plan had not been matured previous to this outline having been published. He believed he might pledge himself that, at the proper time, the full scheme would be brought before this Society, when all the facts and figures would be given. He might state that the estimates in the report were not matters of guess. The details had been duly worked out, and might, he believed, be fully relied on.

Mr. NICHOLAY (who had taken the chair upon the retirement of Lord Ebury at an earlier stage of the meeting), said they had a duty to perform to Mr. Baker by expressing their acknowledgments to him for having brought this subject before them; he would, therefore, propose a vote of thanks to that gentleman.

A vote of thanks was then passed to Mr. Baker.

TWENTY-THIRD ORDINARY MEETING.

WEDNESDAY, MAY 19, 1858.

The Twenty-Third Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 19th inst., J. Griffith Frith, Esq., Member of the Council, in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Crowley, Jonathan Sparrow | Cutler, George Octavius

The Paper read was—

ON THE ENGLISH SETTLEMENT OF THE HILL REGIONS OF INDIA.

By HYDE CLARKE.

The extension of English colonisation in India is a subject which has no reference to mechanics, like most of the Papers brought before the members, but it is one having an equal claim on our attention, as coming strictly within the purposes of our Society for the Protection of Arts, Manufactures, and Commerce. It is one having the stronger claim on our attention, because this is the only Society in the metropolis before which Colonial questions can be brought for discussion or investigation. This is a proud title for the Society, for it may indeed boast that it has in the century of its existence done very much for the advancement of Colonial interests, and thereby for the general prosperity of the empire. Of all our Colonial interests, those of India, not commonly recognised as a Colony, are among the most important. Too long considered as the special province of a commercial company, India has scarcely received the notice it deserves as a constituent portion of the empire. Too long secluded by the jealousy of its administrators, and by difficulties of access—held up as a country which it was impossible for the outside Englishman to understand, and for which it was dangerous to legislate, India has been removed, as it were, from the pale of public opinion and the influence of public sympathy, until terrible events have made India the grave topic of the day. A fabric of administrative wisdom, which had received the highest praise and gained implicit confidence, has been shaken; a military system, which as it was flushed with glory and conquest, was thought to have surpassed in wisdom the Roman organisation, has exposed India to all the horrors of a barbarian invasion, and its soldiery have perished on the gallows or by the artillery of their own generals. A fearful conspiracy directed against those of our citizens and soldiers, our women and our children, who were resident in India, has by its atrocities harrowed our feelings, and excited our watchful anxiety during the vicissitudes of its crimes and its castigation. In the end we have reconquered India against our native army, by our own people, by the victories of the Lawrences, of Havelock, of Campbell, Outram, Inglis, Peel, of hero captains, and of hero soldiers—it may be said, of heroic and martyred women. What we have gained by our own hands, we can with the same help keep, and instead of governing India merely for a native soldiery and to uphold native prejudices and native vices, we may at length take a personal share in the welfare of India.

From the moment that the first English conquests were made in India, the question has naturally been entertained of the extension of English population there. This has occupied the minds of Clive, Hastings, Wellington, Munro, Bentinck, Ellenborough, Dalhousie, Canning, and, indeed, of every great statesman who has been connected with the country. Until a late period, although some may have wished for the introduction of such an element in the population, the prevalent disposition of Indian statesmen was, on various grounds, to exclude Englishmen from India. Still the question was never lost sight of, and several plans, general or partial, were brought forward for promoting such settlement.

The proposition of Sir Macdonald Stephenson, the chief pioneer of Indian railways, to connect Calcutta with the hill Sanitaria, by a branch line, was made before the revolt, and has been since supported. In support of this undertaking, I published a work on the Colonization, Defence, and Railways of our Indian Empire, in which the general system of hill settlement was laid down. The revolt breaking out suspended the railway projects, but its events afforded abundant confirmation of the justice of the system proposed, and the subject having been taken up by Dr. Archibald Campbell, the Superintendent of Darjeeling, Mr. J. Ranald Martin, the author of the standard work on the Climates of India, Sir C. E. Trevelyan, Dr. Hooker, the Himalayan traveller, Sir Macdonald Stephenson, Gen. Tremenheere, Prof. Newman, Dr. Robert Barnes, and Prof. P. L. Simmonds, among others, and supported by the press in England and India, it had so far advanced in public opinion, that the member for Dumfries, Mr. William Ewart, felt justified in bringing it before Parliament, and, pressing the matter with energy, has obtained from the Government and the East India Company the concession of a Select Committee, which has been sitting for weeks, and has collected the most valuable evidence. What, at its first suggestion, was received as an absurd or chimerical proposition, is now acknowledged, under Mr. Ewart's auspices, as a most important measure, and in the recess it will have made such progress in India, that it will be ripe for legislation in the ensuing session of Parliament.

Such is the subject proposed to be brought before you this evening, and, thanks to this Society, this is the first public occasion, not excepting the debate in the House of Commons, which the advocates of this measure have had of fully explaining their views.

The word English "colonization" of India, although it expresses the idea meant to be conveyed, is however, open to misconstruction, and has been misconstrued, for, by attributing to it the idea of operations of emigration like those to Australia, it has been assumed that we propose to form agricultural colonies in the hills, and to send out agricultural labourers in masses. This misapprehension has been wielded as an argument against us, and as demonstrating the absurdity of our views, for want, perhaps, of better arguments against us. To avoid this misapprehension, it has been proposed to use the phrase "English Settlement in India," though it is not more precise.

It is as well to state that the advocates of the extension of English settlements in India are perfectly aware that much of the hill regions is as barren as the like districts in Switzerland or the Scotch Highlands, and they have never contemplated agricultural operations on such a site. What our supporters look for are results perfectly practicable, which are founded on experience, and are therefore the legitimate development of what has been already effected. We expect that, by placing a considerable English population, civil and military, in the healthy English climate of the hills, we shall form thereby a secure centre—not merely for the domination of India, but for its thorough civilization. While we shall have there a compact population physically and morally healthy, we shall be able to extend its influence on the plains, and, indeed, without this concentration, we feel we shall achieve but limited results from the small European population of the plains dispersed among the millions of India.

For the purposes of the investigation in which we are now engaged, we must consider India as including the neighbouring mountain regions and the northward frontier, more or less connected with it politically. This territory, so assumed, we may at once divide into two great portions, the countries of the hills and those of the plains, differing in climate, productions, and generally in physical conditions. The plains are capable of producing in abundance tropical crops, and teem with population; the hills are, to a great extent, barren, and, so far as they can be turned to account, afford the vegetable and animal productions of temperate climates, and they contain, likewise, valuable mineral deposits. The plains are generally unfavourable to European constitutions; the hills contain many sites healthy and with congenial climates. The hill regions form, therefore, the natural habitation for an imported European population.

Although factories had been earlier established, Bombay, acquired from the Portuguese in the reign of Charles II., may be considered the first English territorial possession. The terms of the charter granted by that king to the East India Company, and the institutions thereby established in the city, shew that it was contemplated to form there a settlement, like those formed at the same time in North America and the West Indies, with English laws, privileges, and institutions.* The Recorder's Court, which has merged in the Supreme Court, is an evidence of this implantation of English law in India; but, otherwise, this first attempt at settlement has borne little fruit, for the commercial and monopolising projects of the East India Company and their political exigencies long closed India to English enterprise, nor was it till of late years that these restrictions have been, by piecemeal, relaxed, and now, though the enactments are consigned to the grave, their ghosts are not laid.

* Of this early occupation some interesting details will be found in the appendix to the second volume of the Viscountess Falkland's "Chow-Chow."

In the last century, our great Indian empire was formed by conquests in the plains of Bengal and Madras, and, for the first quarter of this century, our empire was extended chiefly in the regions of the plains. Later events have made us masters of the Neilgherries and the long western coast range, have given us a domination over the mountains and table-lands of Central India, and have extended our bounds within the Himalayan system at many points, from east to west.

At first, the governors and authorities of Bombay began to seek the neighbouring mountains as an occasional refuge in the hot season; then the district of Poona became a residence more or less permanent. Slowly the Neilgherries were resorted to by invalids, and, at length, by the Madras authorities. Bengal was later in this history, because Calcutta, its chief seat, is many hundred miles from the hills. The extension of the presidency, and the formation of sub-presidencies to the west, have led to permanent establishments in the hills.

The hills were first resorted to as places of occasional and temporary retirement from the tropical heats; then a few wealthy invalids sought relief, and the advantages of the climate being acknowledged, the Indian government established the Sanitaria, and thereby laid the foundation of that system of permanent English settlement now in progress, and which it is sought to promote. These, in the first instance, were slowly and sparingly formed as depots for invalid English soldiers, but with the intention of making them permanent stations for a portion of the English force. Practically, this intention has not been fully accomplished, for Darjeeling has never had a battalion cantoned there, and the troops in the west have, the most part of their time, been engaged in the several wars in the valley of the Indus. Still, at the outbreak of the last revolt, it was from the hill stations that the freshest troops were sent for resistance to the mutineers.

These Sanitaria have been so successful as invalid stations for civilians, officers, and soldiers, that they have been adopted as a permanent institution of the armies of Bengal, Bombay, and Madras. There being many persons in easy circumstances among the civilians and officers, shopkeepers and other settlers have been induced to resort to these stations. Still they form but very small towns, although such a place as Simla may on the visit of a Governor-General have twenty thousand people flock into it.

The tea cultivation, singularly enough, has been an auxiliary to this hill colonization; for being suited to the neighbouring districts, admitting of European superintendence, and having been found successful, tea gardens are spreading in Assam, Darjeeling, Sylhet, and elsewhere in the northern regions.

The history of English settlement in the plains is brief. At Surat, Bombay, Madras, and Calcutta, an English mercantile population on a limited scale naturally grew up, and at the three latter ports has of late years become important. Throughout India the English civil and military servants of the Government, relatively few in number, are to be found. The only independent English population in the interior consists of the indigo planters, a fine body of men, of healthy habits and independent bearing, and whose healthfulness is by themselves attributed to their habit of spending much time in the open air. At the large stations are a few shopkeepers. Throughout India, from thirty to forty thousand English soldiers are dispersed. Most of the wealthier English are married to English wives, but their children are sent to the hills or to England, and India is not chosen as a permanent abode. There is a small body, however, of white descendants of the soldiers, and of Eurasians and half-castes, who are the only permanent representatives of the occupation of India by the English race, and very unfavourable representatives too. While the Mahommedans of immigrant or indigenous blood

form a seventh or sixth of the population, the Indo-English do not form a ten-thousandth part of the population of India.

The causes which have impeded English settlement in India have been—1st, the expense of transit; 2nd, climate; 3rd, legislative prohibitions; 4th, the imperfections of the governmental system, and the indifference or hostility of the administration.

As there have been very few passengers yearly to India, the rates have been high, and the accommodation for the lower classes of passengers inferior. The rates paid by the government for the conveyance of troops are, however, moderate enough, and with the flow of a regular traffic, intermediate and fore-cabin passengers could be carried at Australian rates, more particularly as there is a large mass of tonnage regularly employed in the Indian trade.

Internal transit was heretofore in a very unfavourable state, but with the late spread of river steamers and of railways, a settler can be quickly and economically conveyed to the hill regions, or the chief cities of the plains.

By the simple organisation of an emigration department, arrangements would be made which would place India within the reach of the small capitalist and the mechanic, as Australia is.

Second, as to climate. It must be observed that the hill regions are only now becoming available, but that there is already scope for settlers in the hill towns. With regard to the plains, they are favourable to persons of temperate habits engaged in out-door pursuits, but unfavourable as a general principle for mechanics and persons of sedentary habits who would resort to the towns. The refuge of the hills, however, now allows Calcutta and the other cities of the plains to be occupied by Europeans, as New Orleans and the cities of the Lower Mississippi are. Of the hill climates all that need be said is, that they are as healthy as England, and that relatively to the plains the deaths of European soldiers are only as one to two.

Positive prohibitions formed the third head referred to. These were levelled first at the entrance of independent Englishmen into India, and next to their acquisition of land or enjoyment of political privileges. These have all been abolished.

Although the positive prohibitions to English settlement are abolished, settlement cannot be said to be favoured from various causes, which have yet to be remedied. The first of all is, that an Englishman in India finds himself in the only part of the empire where he is deprived of the rights of citizenship and of self-government. This is maintained by some authorities under the plea that to allow an Englishman English rights in India, is to give him an advantage over the native, which is alleged to be unfair, because the natives, in a mass, cannot on any sane political grounds be endowed with English rights at this time. The injustice of depriving an Englishman of his rights within his own territories, is not regarded by these lovers of native rights, whose real object is to reduce the Englishman to the same jurisdiction of the English and black civil servants, to which the native is subjected. The genuineness of the objections can, however, be tested in a very simple manner, for surely it would be better to elevate the Hindoo than to depress the Englishman. Inasmuch as Hindoos have hitherto been exceptionally governed by Hindoo law, Mahomedans by the Koran, and the English at the presidency towns by the Supreme Court, it is no more exceptional that Englishmen shall be governed by English law throughout India. The natives can be elevated in mass by the gradual improvement of their own institutions, and individually, those possessing a knowledge of the English language, and the other qualifications required, could be allowed to obtain English citizenships and English privileges. Thus the whole country would be gradually raised to a higher standard, instead of the best part of the population being debased beneath their own standard to a very low one, for a low one is that which, depriving an Englishman of the verdict of his peers, places him at the mercy of corrupt native judges and officials, and corrupt and perjured witnesses, evils if not inseparable from the native character, at any rate such as cannot rationally be expected to be remedied in the present generation.

The land regulations are radically vicious, for however the subject may be mystified, it remains as a positive fact that there is no freehold tenure throughout India, but a kind of copyhold or, at the best, a tenure in petit serjeantcy, or on chief rent at the mercy of the Court of Exchequer, a system of tenure common enough in the middle ages, and which, on account of its vices, has been abolished throughout Europe, and a freehold tenure substituted. To demand a freehold tenure in India, is not as represented to demand the abolition of the land-tax or exemption from taxation, but simply to demand the application of justice and common sense. To take the example of Canada, the quit-rent system has been abolished, the exactness of the seignorial (or zemindarial) tenures has been provided for, but land-tax for general and local purposes is regularly levied. There is no valid reason why in any part of India, by judicious regulations, the land tenures should not be corrected, even in Bengal, where all the privileges of private property, as against public rights, are now claimed for the zemindar. The zemindaries may be divided up, a power of enfranchisement from zemindarial rights granted to tenants, and the benefits of measures correspondent to the Encumbered Estates and Copyhold Enfranchisement Acts be conferred on the resident population. The East Indian government has been liberal in the grant of lands under quit-rents for tea plantations, but nothing short of a free system will secure the development of English enterprize, and the advancement of the native population.

The administration of justice, as already intimated, is repugnant to English notions. The English magistrates are very few—in some places one to a million of people—they are frequently removed to other parts—their native assistants are inefficient—and as to the police, it is admitted on all hands to be defective. The scarcity of magistrates renders justice dilatory, and favours injustice, and the police are looked upon as instruments of oppression and accomplices of vice. The number of magistrates, it is acknowledged, must be increased, and the police put under English superintendence. With the progress of English population, justices of the peace may be appointed from the English and qualified natives, as in the colonies.

The centralization of the Government, and the want of municipal institutions, is another obstacle in the way of the settler, and which a more numerous English population can best remedy. Then municipalities may be granted to the towns, and the county magistrates carry out the district administration.

To the covenanted service, a body of superior civil servants in India, has been awarded by many good authorities the praise of being the best educated and ablest administrative body in the world; but so far as English settlers are concerned, the government functionaries have acted rather by way of discouragement than of inducement. It is not that there is any positive legislative restriction in the way of the settler, but he is deprived of his rights and placed at the mercy of the government judicial and revenue officers, whose wish is to place him on a level with their native dependents. A spirit of cliquism keeps the settler outside the magic circle. The one or two civil functionaries, and the three or four military officers of the station, treat him as an inferior; the natives may annoy him without fear of discountenance, and, indeed, in many parts of India, the relation of the Englishman to the community around him, is not much better than that of the free black in the slave states of America. The indigo planter, by English spirit, may, in the long run, discomfit the Zemin-

dar, and keep the native officials and police in check, but he may be subjected to annoyance, pilfering, and loss to no small extent. So long as the governing body form a caste apart, no education and no talents will redeem the free settler from a position of undue dependence, and nothing short of his participation in the administration of justice as in other colonies, will secure him fair play, and, in the case of India, advance the condition of the local population.

Whatever local circumstances may be alleged as affecting the political and administrative arrangements of the lower districts, in the hills the population is scanty, and without any political claims, and it is perfectly practicable to afford the English settler full English rights, and to place the local population under English law and administration.

The inquiry now in progress in the House of Commons is making known the true state of the facts as affecting the English settlers, and the result must be at an earlier or later period to remedy all the evils complained of, and although for a time the prejudices of the governing caste may be shocked, in the end their patriotic instincts will prevail, and they will themselves be assisted to carry out to a far greater extent than they have yet been able, the many noble measures they have framed for the welfare of the millions under their charge.

If we look to the present condition of India, great as may be the misery of many districts and of many classes of the population, it is undeniable that great improvements have taken place throughout the country. The administrators have shown an earnest desire to purify the Courts of Justice; they have abolished suttee, infanticide, thuggism, gang robbery, and other abuses, and they have greatly contributed to the security of property and the safety of life and limb. All this is purely owing to English influence, to the influence of the civil and military functionaries.

If we look at the commercial advancement, it is likewise to be attributed to English influence, either of individual enterprize or assisted by government co-operation. Take, for instance, the indigo cultivation, which has created a great staple for India; then the commerce in cotton, which produced a few thousand pounds in the last century, and has been raised to a hundred million pounds, exclusive of exports to China.* The opium trade is another great resource for India. The culture of sugar has been improved and extended, so likewise has that of silk. Rice is an article of large trade to England and China. Jute is a substance hardly known a few years ago, except as dunnage, and which is now a valuable raw material.† The seed oils have of late years suddenly sprung into commercial importance. Sheep's wool and goats' hair, which were trifles, every year are exported in greater abundance.‡ Teak, for shipbuilding, had its established place in the English market. Tea must again be named as a growing export. All these branches of commerce are the results of English enterprize, and were it not for English exertions they would have remained barren.

These are unmistakable results, to be proved by the official tables of trade and shipping, but within the country the same influence is at work. Steam navigation has been introduced on the coasts and rivers, railways have been begun, telegraphs are laid down, coal mines are opened, gas is manufactured, the rivers are spanned by the suspension bridge, and indeed every improvement of Europe and America has been naturalized in India, which has been thrown open to the free commerce of the world.

Looking at these facts we assert that the English element is the chief one in the advancement of India, the whole experience of the past proves it, and we call upon the public, and we call upon the legislature, in the interest of England, and the interest of India, to take measures for the infusion of English blood into that country.

One of the first steps towards this is, we assert, the encouragement of the hill settlements, and of English emigration to those districts, and thereby as a certain result increasing the number of English settlers in the plains.

The districts available for occupation we may broadly assign as the whole frontier region of the Sub-Himalayas and its extensions, from Assam round to the limits of the Punjab, including Cashmere and Nepaul; the ranges of Central India on each side of the Nerbudda; and the Western Ghauts with the tablelands adjoining it and the Neilgherries. Whether the Burdwan range can be advantageously occupied is yet matter of research.

The higher mountain sites, which are best adapted for towns, garrisons, and permanent residences, are in many cases destitute of immediate agricultural resources, but in other regions there are large districts near at hand, available for all the productions of temperate or semi-tropical climates. Such are Cashmere, Mysore, and extensive districts in the Dekkan. Where centres of settlement have been provided, the English immigrants will spread as they have done in Ceylon, and, instead of India, as a whole, being regarded as inimical to English constitutions, it will be found that the greater part of it is readily accessible to enterprize, and an immense extension of production will take place. Then shall we see coffee under English capitalists as in Ceylon, sugar as in the Mauritius and Natal, and cotton as in Louisiana.

Parisnath, in the Burdwan range, has been pointed out for settlement by Sir Macdonald Stephenson and others, and if this can be done, another healthy station will be found for Calcutta, in a country affording great mineral resources in coal and copper mines.

Assam is a district acquired of late years, in which the establishment of the tea cultivation has brought it under European superintendence and influence. In this remote country the Assam Tea Company and many private individuals have founded tea plantations, and to such an extent that the crop of the company alone in the year 1857 was 710,000 lbs. Many parts of Assam are unhealthy, but there is the choice of sites, and as there is abundance of new land, and sufficient cheap labour, new factories are springing up, houses with galvanized iron roofs are raised, and steam-boats are run on the Burrampooter.* In these villages and tea stations many English residents are to be found, and there is ample scope

* John Chapman, "Cotton and Commerce of India."

† See P. L. Simmonds, "Commercial Products of the Vegetable Kingdom;" and likewise P. L. Simmonds, "Dictionary of Trade Products," for this and other articles.

‡ My friend, Mr Daniel Hazard, has favoured me with the following return of the Indian wool trade.

An Account of the Number of Bales of Sheep's Wool imported into the Ports of the United Kingdom, from Bombay, during the following years:—

1835	1,397 Bales.	1847	8,123 Bales.
1836	3,493 —	1848	16,923 —
1837	5,665 —	1849	11 041 —
1838	6,117 —	1850	9,704 —
1839	5,674 —	1851	12,596 —
1840	7,611 —	1852	22,130 —
1841	10,563 —	1853	35,540 —
1842	11,876 —	1854	43,540 —
1843	6,594 —	1855	42,029 —
1844	6,741 —	1856	47,264 —
1845	10,065 —	1857	57,985 —
1846	11,279 —		

(Average Weight per Bale, 334 lbs. gross.)

N.B. The average value of East India wool may be estimated at £8 per bale, so that the 1,397 bales imported in the year 1835 may be put down at £11,176. And, during the next 22 years has increased to the extent of—57,985 bales, worth £463,380.

* See the *Illustrated London News*, August 15th, 1857, quoted in "Colonisation, Defence, and Railways in India."

for enterprize. Besides tea, sugar, rum, lac-dye, timber, and caoutchouc, are articles of English trade.

Cachar, one of the divisions of Assam, produces tea of good quality. A company has been formed, called the "Cachar Tea Company," and there are a score of other tea-plantations. The war alone has stopped the influx of Europeans. The military duties are performed by hill-natives, called Kookies.

The Durrung division of Assam has two tea establishments, a lac dye manufactory, and a military church. Lac-dye is one the articles to which English enterprize is now being extended.

In the Gowalparah division of Assam, the English have engaged in the timber trade, and are working the forests of the uplands. Here, as in other parts of Assam, English schools are established.

Kamroop, or Gowhatty, has several English establishments for tea, timber, the manufacture of caoutchouc, lac-dye, and rum. There is a station of the American Baptist Mission. The troops are native, consisting of Assam Light Infantry, of which there are two regiments. Throughout the hill stations it will be observed that the natives have become readily associated with us, and consisting of tribes of distinct origin, and having no sympathy with the people of the plains, can be safely enrolled, and have rendered considerable services during the late commotions. Thus they are induced to value the English alliance, and are trained up as good subjects. Caoutchouc, it will be seen, is, in this district, a result of English enterprize, as are the products of the forests hitherto unutilised.

The Luckimpore, or Debroghur division of Assam is one of the tea districts, and there are tea gardens at Chubwa, Dikkun, Myjaun, Disraalle, and other places; one of these companies or firms employs three English assistants. There is a church.

Nowgong, in Assam, is a tea and sugar district. There is an American Baptist Mission Station—Assam being one of the districts in which the American Baptist Society co-operates with us for the civilisation of the natives.

Seebsaugur is the great tea district of the Assam Company. They have here five tea-gardens, and employ fourteen English, including a civil engineer, a surgeon, and an accountant. The American missionaries have, besides chapels and schools, a girls' boarding-school, and a printing-press, from which is issued a monthly paper in Assamese.

The Golaughaut district of Seebsaugur includes tea-gardens and sugar works.

Throughout Assam is a considerable native population, available for the supply of labour, and it has the advantage of the large navigable stream of the Burrampooter, with its steamers, as an outlet for commerce, communicating, though by circuitous routes, with the port of Calcutta.

Attached to the Assam Government or Commission is that of Sylhet. The productions of this district include coal, iron, limestone, timber, lac, caoutchouc, wax, honey, betel nuts, oranges, cassia, tea, and cotton. It will be observed that these are chiefly mineral and forest products, affording good scope for the application of capital and enterprise in obtaining the raw products, and in preparing them for the market in the first manufactured state.

Sylhet is a hill country, which has likewise been occupied for tea plantations, and a sanitarium has been formed here, named Chirra Ponjee, but the climate, though not unhealthy, is very wet. It was selected as a European station on account of its elevation and healthiness, and is on the high road from Sylhet to Gowahatty.* The neighbouring wild tribes of the Kasias and Garrows gave some trouble at first, but the settlement was formed. It is on a flat table-land, three miles long and two broad, and where the settlement is it is bleak and barren, with scarcely a shrub or tree to be seen, except clumps of the screw pine. The low white bungalows are few in number and very scattered, and there is a church. For this barren aspect the views from the margins of the plateau are a compensation, and are described by Dr. Hooker in glowing terms for their magnificence. The climate is so wet that Dr. Hooker recorded thirty inches of rain in one night, and Mr. Yule, 264 inches or 22 feet in the month of August; thus the little streams about Chirra will rise fourteen feet in as many hours and inundate the whole flat; but the natural drainage is so complete that it actually makes the soil sterile. Coal, however, is very cheap, so that the residents have protection indoors against the damp. Under these circumstances, Chirra has gone out of favour, and given way to Darjeeling as a sanitarium for Eastern Bengal, but it has several residents, and a church dedicated to St. Bartholomew. In the district of the Cossyah and Jynteah hills are the mines of the Sylhet Coal Company, and limestone is likewise wrought for the supply of lime to the low countries. The mines of the coal company are at Larkabong and Chirra Ponjee. The coal is described as of good quality. At Sylhet is the church of St. Michael, and at Sheik Ghaut, in the neighbourhood, is an establishment of the Welsh Missionary Society.

* Hooker's Himalayan Journals, Vol. 2, p. 273.

One of the most remarkable events in connexion with Sylhet, is the discovery, as proclaimed by the government, that the tea plant is indigenous in the pergunnahs of Ruffeenuggur, Chapghat, and Paunchkhund, the trees having been found to the number of many thousands, almost entirely on waste jungle-land in Ruffeenuggur and Chapghat, and on the teelas or detached hills, 400 or 500 feet high, in Paunchkhund. As this land is all unsettled, the government at once issued regulations, offering it liberally for settlement in grants of not less than 500 acres free at first, and with a gradually increasing quit-rent, grants of hill forests being on special terms.

Darjeeling is one of the most important places in connexion with the English settlement of Bengal. Lying due north of Calcutta, with railway and steamboat communication, open or in progress half the way, a small amount of enterprize will bring it within a few hours reach of Calcutta. Its advantages were first discovered about the month of February, 1828, by Mr. J. W. Grant, of the Civil Service, at that time resident at Malda, and by Captain, now Major-General G. W. A. Lloyd, who were employed in settling the boundary between Nepaul and Sikhim. These gentlemen represented the facts to the Governor-General, Lord William Bentinck, in 1829, and that great man, it is said, never lost sight of the expediency of establishing on this tract of the Sikkim hills a station for the relief of those whose health demanded relief from the heat of the Bengal plains. He directed Major Herbert, Deputy Surveyor-General, to explore the site, and the results having been brought before the Court of Directors, they highly approved of the plan, and extended it with a view of its forming a depot for the temporary reception of English recruits, and even as a permanent station for a European regiment. This undertaking likewise received the fostering care of Lord Auckland during his government, as also of the successive deputy governors of Bengal, and of the present Governor-General, Lord Canning.

The situation of Darjeeling is in a spur of the Great Sinchal mountain, which itself rises nearly to a height of 9,000 feet, throwing out several spurs. One of these is Darjeeling, a hog-backed ridge, with a steep descent on its eastern side to the torrent of Rogno, and on the west and south-west declining in more gentle declivities, broken into knolls, and intersected by numerous streamlets, and forming a fine amphitheatre, extending from two to three miles, and dotted with villas, military establishments, the civil offices, the church, hotels, and other buildings. On other spurs are several neighbouring villages and hamlets, for Darjeeling has already become a

small centre of colonization. In the neighbourhood, nearer or further off, are Gnadenburg, the German mission, Hope Town (an English settlement), Leebong, Jelapahar, Tagoar (the tea plantations of Capt. Masson), and Kursion.

The great attraction of Darjeeling to visitors is the noble view of Deodhunga, 29,002 feet high, of Kunchinginga 28,176 feet high, and some of the highest peaks of the Himalayas, affording perhaps the grandest scenery in the world. Thus, in the future of Darjeeling is its situation as one of the chief places of resort by the Indian traveller.

Darjeeling is a small place, according to English notions, and is little more than a village, but is rapidly growing in importance. It has a church, Baptist and Roman Catholic chapels, nunnery, boarding and other schools for boys and girls, public library, masonic lodge, hospital, treasury, jail, hotels, and various shops. It is one of those places to which English children are sent for education, and there they get the rosy cheeks of old England. There are numerous residents for health occupying the villas. The military establishment consists of a hill corps, a body of English invalids, and this year cantonments are prepared for an English battalion.

The neighbouring district, a part of Sikhim, now belongs to the English, and includes a population of 50,000, available for labouring purposes. The remaining district of Sikhim is dependent on England, and can be likewise occupied for settlement when the necessity arises.

The great value of the Darjeeling and Sikhim territory arises from its lying between Nepaul, Thibet, and Bhootan, on one of the natural routes to Central Asia, commanding the trade on the eastern frontier. The produce and exports from these districts include gold-dust, iron, copper, lime, woods, tea, wax, ginger, catechu, cassia, coffee, cotton, hemp, gunny, rice, cardamoms, oranges, potatoes, ghee, hides, horns, musk, wool, chowries, blankets, woollen cloths, and many other articles.

As a political position, it commands the countries referred to, and prevents the Nepaulese from seizing Bhootan, which they are anxious to do, and whereby we should have those dangerous neighbours, the Goorkhas, now our allies, spread further along our frontier.

At present we have but a small share in the trade of Central Asia, Chinese tea being brought from 2,000 miles off close to our border, Russian woollens and manufactures being likewise imported to Thibet.

The rise of Darjeeling, and the attention which it now attracts as an advanced post for the promotion of English influence, is chiefly owing to the exertions of Dr. Archibald Campbell, the superintendent or governor, who is one of those remarkable men to whom we are indebted for building up and preserving our Indian empire. Campbell has done on a small scale what the Lawrences have done with the kingdoms under their rule. A small outpost he has made a province; he has subjected the neighbouring rajah, promoted agriculture, created commerce, encouraged settlers, and enlisted troops. In the late disturbances, by his influence he raised considerable recruits among the Goorkhas, held his own, and afforded assistance to the superior government. He has introduced the culture of tea and other articles, and has made important experiments on cotton in the lower districts. There he has succeeded in growing the sea-island cotton, and is now prosecuting further trials. He has been very active in promoting roads and the railway, and has lately again called the attention of the Supreme Government to the trade with Thibet.

In 1849 I proposed to extend the telegraph to that station, a measure since approved, and Sir Macdonald Stephenson afterwards projected an extension of his East Indian Railway in this direction. Last year we brought this subject before Mr. Campbell, who has done much for its prosecution. It will be observed that Darjeeling lies about 375 miles north of Calcutta, that the East Indian Railway proceeds north-westerly, as far as far as Rojinahal, and that consequently the branch to give Calcutta a complete northern line and connect it with Darjeeling is under 200 miles. The name of the company for the new line, is the Northern Bengal Railway Company, which is now in communication with the Indian Government for obtaining the necessary authorization. The Government have received reports in favour of Darjeeling as a situation for English settlement, and have sent out to obtain the opinion of the local authorities as to the best means of encouraging a railway or tramway.

This railway will produce the most important results in Bengal, for while it will enable English and hill troops to be poured down on the plains, it will, on the other side, give to the inhabitants of Calcutta the climates of England or Switzerland, which, in a few hours, and at a small expense, they will exchange for that of the tropics. Only a few years ago the total charge of a first-class traveller from Calcutta to Darjeeling was £25, and the time employed seven days. This has been now much abridged, but the difficulty of access is still the chief obstacle to the progress of Darjeeling, and until the railway is opened throughout it must linger. Then an emigrant passenger will be carried up in a day for sixteen or seventeen shillings.

Passing from Darjeeling, the range of the sub-Himalayas, containing some fine valleys, and country available for settlements, is in the possession of the Nepaulese, and is for the time closed against us. We then come to a group of hill countries, including Kemaon, or Almorah, the Dehrah Dhoon, and Simla.

Kemaon on Kumaon includes the districts of Kemaon or Almora, Gurhwal, and Nynee Tal. This country has attracted attention for its iron mines.*

Almora has an English population as well as a native one. Here is a considerable establishment.

Hawulbagh, five miles distant, has, however, the chief residences, and here are the military cantonments. In the neighbourhood are tea plantations.

Gurhawal has many iron and other mines, but the produce is very small. The forests are under Government supervision. The chief town is Sreenuggur.

At Paronee, in Gurhwal, are tea plantations.

Nynee Tal, in a romantic situation, by the side of a lake among the hills, is the favourite sanitarium in Kemaon. It has been a city of refuge during the troubles.

Bheen Tal is a village, with tea plantations.

Dehrah or Deyrah Dhoon is a district about the size of an English shire. The town is delightfully situated, and is in a good route for trade. The neighbouring country is fertile, but, where uncleared, most unhealthy from rank vegetation. In this district an experiment was made of colonization by invalid soldiers and Portuguese Hindoos, and as it failed as a matter of course, as all military colonies have, and as the Portuguese of India are sure to fail, it is now set up as a stock argument against English settlement in India. The spread of the tea cultivation alone is answer enough to the Dhoon experiment. The town has a church, American Presbyterian, and Roman Catholic church, and a variety of public establishments, among which is a station of the Great Trigonometrical Survey of India. The forests of the Dhoon are of importance, and are under government superintendance.

Landour, near Dehrah, is a sanitary station, regularly frequented by the Meerut officers, and forms a considerable town with military and civil establishments. There are a church and Roman Catholic chapel.

At the village of Woodstock is a Protestant girls' boarding-school.

* See Report on the Metalliferous Deposits of Kumaon and Gurhwal, by W. J. Henwood, F.R.S., and Tramroads in connection with the Iron Mines of Kumaon, by W. P. Andrew.

Mussoorie is so close to Landour, that the towns or villages are almost connected by the rambling villas; it has a church, and there are a Roman Catholic chapel, and a very well conducted Roman Catholic school, or rather college for boys. A nunnery is another Roman Catholic establishment, with a boarding school attached. It will be observed in surveying the hill towns, that the Roman Catholic missionary authorities have very skilfully selected them for occupation by churches, nunneries, and boarding-schools, and as the cost is paid by the pupils from the plains, these become reproductive establishments. At Mussoorie there is a superior church school for boys, and there is a common girls' school, besides two boarding-schools for young ladies. Dancing and music are taught in this remote region. Beer is brewed from native barley at this place, and forms a new and permanent branch of trade.

Kenilworth and Clarkeville are places at Mussoorie.

Simla is at present the most important of the hill towns, and is so far metropolitan that it has been the frequent residence of governor-generals, lieutenant-governors, commanders in chief and high authorities. Like most of these sanitaria, it is perched on a narrow ridge of mountains with dwellings scattered on every available spot, often of narrow area. It was only in 1819 that the first English dwelling was erected here by Lieutenant Ross, but by 1841 it had become a regular English town, and has since much increased.* Sometimes some twenty thousand persons are temporarily assembled, when the Governor-General takes up his abode in the town. In Simla and the neighbouring towns and villages, are to be found many residences. Christchurch is a costly edifice with an organ. There is a Baptist chapel. There are boarding-schools for boys and girls, and five district schools of the Church Missionary Society. The local governor, called a commissioner, is provided with numerous functionaries and establishments. This is one of the few places in India which has a municipality, and the only one which has an English municipality, an institution which it is to be hoped will rapidly extend throughout India. There are an observatory, large dispensary, bank, library, hotels, assembly rooms, type, copper-plate, and lithographic printing-house, and many shops.

Boileaugung is a village near Simla, named after a distinguished engineer officer, General Boileau.

Juttogh is the military station near Simla.

Kotgur is a town 50 miles north of Simla. Here are a Church Mission, a boys' and girls' school of the Church Missionary Society, a school of industry, and station of the Moravian Missionary Society. In the districts are five boys' schools. The Moravian Missionaries have chosen this as a temporary residence, in order to penetrate the interior from this point, and establish missions among the Tartars and Mongols. The tea cultivation has been successfully introduced in this district.

Kussowlee, in the Simla district, is a sanitary station, having large establishments, but suffering from the want of water, which has to be brought from a mile and a quarter distance. The buildings are distributed around a hill of five miles in circuit. There are a church and Roman Catholic chapel. Here is the residence of another Commissioner. A brewery has been successfully established here likewise.

Sanawur, near Kussowlee, is the seat of a most interesting establishment, the Lawrence Military Asylum. This was founded by that great man Sir Henry Lawrence, and is one of the munificent foundations of that noble family. In 1856, it contained 200 boys and 200 girls, orphans of English soldiers, who, among other employments, are taught printing, bookbinding, and electro-telegraphy. It is likewise the Military Normal School for training schoolmasters for the Bengal army.

Dugshaie in the same region is a station of Sirmoor, having an established church and a Roman Catholic Church. In the district a hill regiment is raised. The place is 16 miles from Simla.

Soobathoo, another of these towns, is by some preferred to Simla. The population is chiefly composed of native immigrants and refugees from the hill states. There are a church, American Presbyterian Chapel, Roman Catholic Chapel, and Masonic Lodge. It is a sanitarium, and one of the most healthy stations for troops. In the neighbouring valleys and steep mountain sides, cultivation is industriously carried on, the produce being rice, maize, wheat, barley, millet, ginger, cotton, opium, tobacco, oil-seeds, red pepper, hemp, vegetables, apricots, peaches, walnuts, apples, wild pears, raspberries, strawberries, and melons, being the varied growth of several climates in close neighbourhood.

To Simla and Soobathoo a railway has been proposed from the main lines, but it languishes at present in consequence of the disturbed state of the neighbouring parts of India. Railway communication, however, once established, these military regions would pour down large supplies of troops, fresh and vigorous, as they have done small bodies for the wars on the frontier and for the present intestine war.

The great group of what may be called for the purpose the Simla military towns, is among those which afford the smallest resources for agricultural operations or other enterprize, but the trade consequent on the provision of troops and the gradual development of industry, will hereafter invite many settlers.

We now come to scattered towns, of much later establishment, being the military sanitaria lately formed by the Lawrences and other administrators on the hills adjoining our most western territories in India.

Murree is on a hill between the rivers Indus and Jhelum, in the Punjab, established in 1851. Here of late was the seat of the great Governor, Sir James Lawrence, one of the saviours of the empire. It has already a large population, and includes a military depot, church, the revenue survey department, and many villas.

Dalhousie is a sanitarium and hill station in the Punjab, in the Chumba hills, 120 miles north-east from Lahore, founded quite lately for the Sealkote and Lahore divisions, and named in honour of the late distinguished Governor-General.

Dhurrumsala is another Punjab military sanitarium, with church and small barracks. Here the tea cultivation has been introduced.

Kyelang is a Moravian missionary station in the same province.

Budorodeen, a small military sanitarium, was founded in the Marquis of Dalhousie's Government in 1853, and is between Bunnoo and Dera Ismael Khan.

Abbotabad, named after the distinguished James Abbott, is a military station 22 miles north of Hurripore.

Ghizree is a sanitarium newly established by the Bengal Government in Sind, for the Kurrachee brigade of the division of its army occupying that country.

Our next district is Aboo or Mount Aboo, in the territory of Serohee, in Rajapootama, connected with the Arawulli range, and being the only station of the kind in the ranges of Central India, which it is supposed will, on survey, be found to present many suitable sites. It is a new town, and is a post of the agent for the States of Rajapootana, and has a church and many English invalid residents. Here is another foundation of Sir Henry Lawrence, the Aboo Lawrence School, for thirty boys and seventy girls of English soldiers. It may not be forgotten that a special appeal has been made for the endowment of the Lawrence schools, as a memorial of that eminent man, Sir Henry Lawrence, and of the family.

Erinpoora is the military station of Aboo.

* For information on this and other places, the chief authorities used are *Thornton's Gazetteer* and the *New Calcutta Directory*.

We now proceed further south, to the Bombay Presidency. Along the shore of that presidency, the chain of the Western Ghauts arises like a wall parallel to the sea, and supports the several table lands of the Dekkan. Thus the inhabitants of Bombay by ascending these hills, which the Great Indian Peninsular Railway will facilitate, obtain a refuge during the violent heats. Poona on that railway has long been a favourite civil and military station, and in its neighbourhood various establishments have been formed.

Dapoorie, four miles distant, is a town with botanical gardens. The season residence of the Governor of Bombay is in this district.

Kerkee is a place two miles from Dapooree.

Poorundhur is a sanitarium in this division, having an establishment of invalids.

Mattheran is a hill station in the northern division of Bombay, in Tanna collectorate.

Mahabuleshwar is a small town on a fertile range of the Western Ghauts in the Bombay presidency, but having heavy rains in the monsoons. It was founded by Sir John Malcolm, in 1828. It has a church, library, hotel, bazaar, and invalid garrison. Malcolmpeth is a neighbouring village.

The district of the Neilgherries is a private southern resort for the Madras and Bombay authorities. Ootacamund is its chief town, and is in the Coimbator district. It was founded in 1822. It has a church, public gardens, and meteorological observatory.

Bishopsdown is a place near the town, where there is a cantonment for sick soldiers.

Koonoor is a small station in the Neilgherries, with many English villas, an hotel, and bazaar.

Kotageri is a neighbouring sanitarium.

Kaity is the seat of a German mission in these hills.

One of the best districts for English settlement in India has not been yet named, and that is the valley of Cashmere. By some unfortunate oversight this was assigned to the late Gholaub Singh, as a compensation for his political deeds in the Punjab, though any territory of corresponding revenue would have been equally remunerative to him as Cashmere, on which he had no hereditary claim. His successor may be disposed to exchange this territory on some occasion for an equivalent compensation or revenue, if some additional income be held out as an inducement. This should not be lost sight of by the Indian authorities.

The chief results to be deduced from an examination of the hill regions may now be considered. They afford many healthy sites for the residence of English settlers. They afford abundant scope for the enterprize of settlers of large or small capital in the development of the minerals, field produce, and agriculture, and in commercial operations. They present suitable situations for the cantonment of the chief European force now required for India.

By means of railways and tramways they can be connected with the plains, so that the hill garrisons will as effectually command the lower provinces as garrisons in the unhealthy stations. A great economy in the maintenance of the troops will be effected, while the funds so disbursed will contribute to the resources of the hill settlers, and the population of the hills will be strengthened by the soldiery, their families, and dependents. The hill stations afford the healthiest residences, and by means of railways, convenient stations for the governors and chief officers. The Europeans stationed in the plains can keep their families on the hills, and in case of illness can readily resort to healthy climates. The hill towns, becoming the seats of the clergy, schools, engineers, professional men, and skilled mechanics, will afford unprecedented means for extending a purer religion and morality, and a higher civilization among the millions of India.*

The advance of these settlements will open not only new sources of local trade, but promote intercourse with central Asia, and secure our interests in that direction.

The military resources of the soldiery and settlers will secure the whole of the presidencies of India against internal commotion by their distribution of active forces and reserves among the mountain ranges. The growth of English population and improved communication with the hill tribes on the northern frontiers, will present a secure barrier against Russia, Afghanistan, Nepaul, and Thibet.

New resources will thus be made available for our home population in this great field of enterprize, whence settlers can profit by the development of agriculture and commerce in the fertile regions of Hindostan.

The thorough establishment of the railway system is a necessity for Lower India, and for the proper operation of the hill settlements. Main lines already authorized by the Indian Government run parallel to the hill regions or approach some of the important settlements, and a provision of cheap branch lines or tramways will make the hill towns effective for military or commercial purposes.

On a superficial view, it seems necessary to place the military stations in the great cities, as Calcutta, Delhi, Agra, Benares, and so forth, with the view of commanding large populations and the main positions. A more careful view will show that the most effective plan, on sound military considerations, is to place the chief force in healthy stations, that is to say, in the hill-towns. We have tried the system of garrisoning the cities of the plains, and it has failed during the late calamities, to afford us the required advantages, for good military reasons. The military force in India is not generally required to keep down the local population, but to be held in reserve, ready to suppress any insurrection, or to act as a field force when required. The central hill stations of India would provide better bases of operations than the cities of the plains, but to make either effectual, the communications must be brought into good condition. It was the want of rapid communication which allowed Delhi, Cawnpore, and Lucknow to maintain their insurrections and hold out against us, and the forces required for their reduction were not obtained from the local garrisons, but from without, from the north-west, from Calcutta, and from the southern presidencies. The plan of placing the forces in Meerut, Cawnpore, and the lower stations is in fact a military mistake, for they can only be kept there at great loss of health and efficiency, the deaths being two to one as compared with the hills, and rendering the assistance of native auxiliaries necessary.

In a political point of view, the garrisons must be placed in the hills, and the railway system extended. The result will be that English settlement will be encouraged

* Major-General Tremenheere, in an able paper on "Public Works," read before the Institution of Civil Engineers, on the 4th of May, said:—"One great deficiency in India was the almost total absence of trustworthy and well-instructed European subordinate agents, which was the first difficulty to be encountered in the prosecution of any enterprize, or the execution of any great works in India. The author proposed that this defect should be remedied by training the children of the European soldiers in India in industrial establishments, to be formed in the Himalayas; and he showed that thousands of English soldiers continually perished in India, without adding to that very element in the settled population of the country which recent events had shown to be so much required. Those children who were born in the barracks died in the plains, in the ratio of four out of every five. There were at this moment 900 children of soldiers at the station of Dum Dum, near Calcutta, most of whom might be saved and be turned into useful overseers, trained agriculturists, and teachers of various branches of skilled industry, if they could be removed to the hills. The author also proposed, with a view to increase the European population, and the settling in India of the lower and middle classes, that the permission for the marriage of soldiers going to India should be extended beyond its present limit of 12 per cent."

without any special outlay taking place, and without the exercise of any special patronage. Thus what we ask is not an enormous expenditure, as alleged, for an experiment in colonization for the benefit of the emigrant classes in England, but only that those measures shall be carried out which are imperative for the good government of India. Seldom is there an opportunity such as this for carrying out a great public measure with facility, requiring careful watching and guidance rather than calling for pecuniary outlay.

The same railways which carry the soldier and his equipments speedily and economically, will carry the settler and the trader cheaply, and enable them to penetrate the country, and it is easy to trace this operation. In the United States or in Canada where the railway system has been applied to a thinner population and a less productive country, the Irish or German emigrant who arrives at New York can travel a thousand miles in a few days, and reach the lakes in the far west for very few pounds. To reach Darjeeling or Simla now he must spend a small fortune, lose time and hazard his health. With the railway he will reach a place of settlement in India as readily as one in Michigan or Canada West.

What we want for India is what has been given to Canada. This conceded, we shall achieve the like results. Prices will rise, labour be enhanced, land increase in value. In India the labourer now earns two shillings a month, and the whole rent and taxation of an acre of land is some eighteen-pence a year. In the Western World, on the other hand, labour is scarce and high-priced, and waste land will sell for as much in many places as the cultivated land of India.

Thus, the grand operation of improved communication will be productive of important economical resources, not only by increasing the real wealth of India, but by creating higher prices.* If these consequences be carefully provided for, the advantages must be great to the metropolitan country and to India. Lands now worth from £1 to £2 per acre, will fetch European prices, and the Government, while receiving a higher revenue, may for the enfranchisement† of the land and the creation of a freehold tenure, acquire a compensation enormous as is the extent of land dealt with, and the population interested in its cultivation. In speaking of the public rights in the land of India as equivalent to the redemption of the national debts of England and India, and as affording a large fund for public improvements, I have been suspected of extravagance and exaggeration, but whoever carefully watches this subject will see that it is one of importance, and that in this part of the good government of India is to be found a rich and legitimate reward for our labour.

Those who have attempted to exclude the English settler from India have set up the doctrine of India for the Hindoos, and talked of any regard for English interests as an invasion of native rights. The time will soon come when the injustice of this dogma will be seen, and England will not rest satisfied with passive self-gratification in the welfare of India, but will claim her share in the resources of the empire. The United States, on the acquisition of California, possessed themselves, for federal purposes, of the land revenues, customs, postage duties, and supreme court fees, leaving local charges to be met by local taxation. With those funds part of the public expenses of the United States have been met, and the public debt has been reduced. From India we derive not one farthing, and have been subjected to considerable expense for Indian purposes.

If emigration to India be conducted on a sound basis, then measures should be taken to obtain some compensation from the immigrant for the benefits conferred on him, either by the imposition of a small poll tax, or by the apportionment of the land fund, so that a permanent fund may be created to promote English immigration, and particularly female immigration, and in all cases where an advance is made for such purposes, it should be by way of loan, so that being repaid and reapplied, the fund may produce the greatest results. At present, under the Australian, New Zealand, and Cape system, a young man is taken out by means of the Bounty fund, put in a good position as a labourer, and shortly becomes an independent yeoman,—the colonists lose the benefit of his labour in the labour market, as his passage money is not repaid; and another immigrant is only to be obtained by the further operation of the land sales fund, while many claimants are waiting at home to enjoy the like advantages.*

There are several measures to be kept in view for promoting the objects here pointed out. The first is to carry into effect every legislative improvement requisite to place the English settler in his legitimate position. The consideration of these remedies now occupies Mr. Ewart's Committee. Mr. Ewart has called the attention of the government to another important matter, and that is the provision in any treaty with China for free intercourse with Tibet and the countries on that frontier, where Chinese interference now impedes us. Mr. Campbell tells me, in a letter just received, that he is making a fresh effort to obtain the aid of the Supreme Government of India in opening the trade with Tibet from Darjeeling. Another matter is a watchful policy with regard to the hill states of Nepaul and Cashmere. In

* On this subject see the 12th and 13th chapters of my book on "Colonization, Defence, and Railways in our Indian Empire," &c.

† In a very able paper read last night at the Statistical Society, on Indian Finance, Mr. Frederick Hendriks, F.S.S., says:—"Acting upon the precedent of the principle of Mr. Pitt's measure, which rendered the permanent British Land Tax redeemable, a similar course has sometimes been suggested for India. If, however, the carrying out of such a suggestion were restricted in its field of operation distinctly to Bengal alone, or, rather, to those portions of the Bengal presidency where the permanent settlement is an existing institution of the country and cannot be reversed, there do not appear any valid objections to a Land Tax Redemption being effectually carried out. The method should be a cancelment of land tax in exchange for a transfer and cancelment of such an amount of nominal capital in the Indian public debt, as produces an annual dividend precisely equal to the land tax redeemed. A redemption of this kind, not obligatory, but purely permissive, and to be acted upon at the land-holder's own wish, and when his means admitted, would be gradual and self-adjusting; but probably neither the requisite funds, nor the inclination to redeem, would be found wanting in Bengal. But the whole measure of the good it would accomplish is not to be expressed in the mere money result. The middleman, and the inferior servants and agents, who are said to oppress the Bengal ryot, would be more restrained from the power of exercising their love of exaction. And where the state receives, as in Bengal, so large a portion of the rent of the soil, and can disburden itself of the position of chief landlord without any sacrifice, as it would there be enabled to do, it is highly politic thus to increase the number of its freeholding subjects, and, at the same time, to limit their opportunities of oppressing the poorer and hard-working classes. The wealth of the country would be much promoted by the formation of an independent middle class; industrial enterprise would have a better chance of success; a larger revenue from taxation, whether indirectly or directly, would be easier met; European imports would increase; the execution of productive public works would be facilitated; and benefits of the utmost moment to the people of India, and to this country, would be the sure result."

* I have on many occasions called attention to the principle of making emigration more extensive, by making it reproductive. Of late this principle is making way, but on a limited scale. The Cape Commissioners are sending out persons whose friends in the Colony give security for the repayment of the advance. The best example, however, as yet, of the working of such a system, is that of the Mormon Perpetual Emigration Fund, a sagacious scheme of the leaders of that community for increasing the neophytes at Salt Lake. The working of this scheme is one of the chief inducements to conversion in their European missions.

their unsettled condition the necessity of interference will arise from time to time, and then judicious arrangements will provide for the welfare of the population and the advancement of our national interests. The English language should be taught and encouraged, and should, in all cases, replace the Persian and other public languages not being the dialect of the local population. A not less useful step is that advocated by Sir C. E. Trevelyan and Professor Newman, of encouraging the Roman type instead of the Hindoo and Arab types for the printing of government proclamations, school books, and gazettes.

In considering for the first time a subject so wide, it is difficult to avoid trespassing on the attention of an audience, and yet impossible to give that fulness of information and of detail requisite to arrive at a conclusive judgment. Enough, however, it is to be hoped, has been done to show that the subject is of importance, and as it is connected with our Indian empire, so neither in this Society, nor among the public at large, will it, when once examined, be considered unworthy of attention.

The Almighty, who, from small beginnings, has raised the English race to the dominion of these islands, and to the occupation of the continent of North America, and has filled it with a nation of our people, has given us the empire of nearly two hundred millions of people in India, and the destinies of a large portion of the human race. This is an inheritance, wonderful in its extent, glorious in its attributes, a means of doing good whereby not individuals, but millions and nations may be blessed, in the promotion of which there is no citizen among us so mean but he may do his share, no intellect so vast but that there shall always be scope for its beneficial exercise, no effort we can make but what will bear fruit, no noble endeavour but will earn its own reward. Let us each in our sphere use these opportunities faithfully, accepting the responsibilities which have thus been offered to us, and while we shall confer lasting happiness on India, the welfare of our race will be hallowed with new hopes and our empire rest on a still nobler foundation.

DISCUSSION.

The CHAIRMAN said, only a brief time remained in which to discuss this highly-important and interesting subject. Seeing present Mr. Theobald, whose name was so materially associated with the question of India, he should be happy to hear that gentleman's observations.

Mr. THEOBALD felt complimented by the invitation of the Chairman, although, quite unexpectedly called upon to take part in the discussion. He had listened to Mr. Hyde Clarke's paper with the greatest pleasure, and the views that gentleman had put forth fully accorded not only with his own opinions but, he believed, with those of every British settler in India. They certainly wanted those improvements, social, political, and judicial, which had been so ably pointed out by Mr. Hyde Clarke, as it could not be denied that all classes in India suffered from the defects in all those points which had been adverted to. With regard to the climate it had been truly observed that the Presidency of Bengal was one of the healthiest in India. They were in the habit of hearing the claims of the United States of America advanced in a sanitary point of view, as favourable to European constitutions, but he did not believe that the physical condition of the population of the United States was better than that of the residents in Bengal. It was very desirable that their fellow countrymen should be disabused of the notions so generally prevalent with regard to the climate of India. It had been placed beyond all question that the hill countries which formed the leading subject of the paper were, in an eminent degree, adapted for European settlers, as the temperature there was much lower than in the plains. At the same time, it must be admitted that neither the hill stations nor the plains were adapted to Europeans whose occupation was that of agricultural labour, nor was it necessary that Europeans should be so employed. There was native labour in great plenty, which could be procured at a much cheaper rate than European labour. What was most wanted, both in the hill stations and in the plains, was European intelligence, European skill, European civilisation, and he might add, above all, European capital and enterprise, for although many of the natives were very wealthy, they were not persons of enterprise, and did not introduce improvements. They accepted the country, the climate, and the population as they found them; but what was wanted in India was—institutions of a character more in accordance with those which, as British subjects, we were accustomed to associate with the idea of a well-regulated order of things, both social and political. Mr. Hyde Clarke had recommended the establishment of municipal institutions, and the practice of self-government which existed in England, but he (Mr. Theobald) thought that the idea of such institutions was beyond the reach of the experience and capacity of the Indian Government. In the great Presidency cities, such as Calcutta, with a large European population, there were abundant opportunities for municipal management. It was of the first importance that we should be on the best terms with the native population, and he saw no reason why we should not in such cities, and even in the towns of the hill stations, have municipal management. The want of it was greatly felt in Calcutta. He recollected the time when something approaching to that desirable state of things was established in that city; but the government, so unused to municipal institutions, began with that which, even in this country we had not yet attained to, viz., universal suffrage. In the election of municipal commissioners there was universal suffrage; and it was hardly to be supposed that a government constituted as was that of India, would be satisfied with the results of universal suffrage. The consequence was, that those commissioners who had been chosen by universal suffrage were reduced, in the first instance, to half the number originally appointed, and then were made permanent commissioners. He thought a better organization of the Supreme Government was required. It was for the Parliament of this country to say what the form of government in India should be; but, in any case, it should be a system of government which accorded with the feelings of the European population as respected the general administration of affairs. The effect of railways in India would be appreciated by everyone. With regard to the question of land tenure, in every part of India there was a different system; in Bengal proper, which was as large as the entire empire of France, with a population of about 40,000,000, the system of land-tenure was, upon the whole, favourable to European settlement; the effect of which was shown by the fact, that lower Bengal was the only district in which there was any considerable number of European settlers. It was only by a system of tenure in perpetuity that increased European settlement, and the employment of European capital and enterprise in India could be effectually brought about. In the hill-stations, and in Madras and Bombay, the system of government was altogether different. In the province of Oude, which had lately fallen under British dominion, the same system of absolute proprietorship in the soil by the government, as prevailed in Bombay and Madras, had been established, and the rents or assessments were annually collected by an army of police. They would readily imagine that such a system was practically prohibitive of the investment of capital in the soil. What was particularly essential in India, was a proper revenue system, and, above all, due protection to person and property, as well as an administration of justice founded upon equal laws for all classes. In no part

of India did there at present exist a proper administration of justice. The East India Company might be regarded rather as the agent of the Mahomedan government, than as exercising powers in accordance with its own views of what was just and expedient, and the changes that had taken place since India had fallen under British rule. were not such as were to be looked for at the hands of enlightened rulers. An administration of justice, based upon British principles, was urgently required, and where natives were employed as administrators, they ought to be persons properly instructed for the purpose. He was afraid this could not be accomplished without giving the natives a great deal of that sort of education which had not hitherto been given them. They now claimed an excessive share in the administration of all the functions of government, but he (Mr. Theobald) maintained that in order to secure a due administration of justice, they must look upon all classes as holding equal social rights, whether Hindoo, Mahomedan, American, or European—all should be equal in the eye of the law, without distinction of race or creed. That was the British idea of the administration of justice. But in India there was the influence of caste, and the Mahomedan claimed for himself privileges which he was not willing to accord to the Hindoo—in fact, the Hindoo was hated by the Mahomedan, and it was a great mistake to suppose that those different races would exercise towards each other the same impartiality that we in this country should be disposed to show towards them. The East India Company had been opposed to European settlement in India, and to all kinds of settlement by which a social and political position could be acquired. At one period it was the wi·h of Sir John Malcolm to establish a colony of East Indians who, it was to be remarked, were a race almost as distinct from the native population as the natives themselves. Our Indian population, wishing to provide a vent for their surplus population, entertained the idea of founding a colony of East Indians, but in this they were frustrated by the authorities of the East India Company, as it was opposed to their policy to allow of colonization. What was wanted was—a Government actuated by liberal principles to do impartial justice, both as regarded Europeans and the native population. He believed the few points he had adverted to had formed the great bar to European settlement in India.

Mr. P. L. SIMMONDS said that it had been well remarked that it was British skill, energy, and capital, which had already accomplished so much for India. While congratulating ourselves, however, on the successful results of our exertions in this respect, as evidenced in the largely increased trade and commerce of India as compared with twenty or thirty years ago, there yet remained much to be done, and such a paper as the one they had just listened to was eminently calculated to promote that end by calling increased attention in England to the subject of India and its resources. Not but what India had occupied a very large share of public attention during the past year, but this was chiefly concentrated on its social, political, and disturbed condition, and not specially on its agricultural resources, trade, and commerce. The evidences of British skill and capital were brought prominently before them that evening, not only in the excellent paper of Mr. Clarke, but in the photographs taken of the progress of great public works, the maps and plans of railway extension and canalization, improved river navigation, models of vessels suited to those rivers, and the indigenous products, tea, fibres, &c., which were doubtless familiar to many. Hill colonization by sanitaria, the wide extension of the telegraph, the diffusion of the press, of schools, churches, and missionary enterprise were other evidences which had been adverted to by Mr. Clarke. Glancing, however, over that more especial field with which he (Mr. Simmonds) was most conversant,—the commercial products of India—a field of inquiry, in which, since the death of Dr. Royle (who had done so much to develop the resources of India), he was left almost alone, what did they find? He held in his hand a comparison which he had drawn up of the present Indian exports with those of 20 or 30 years ago. He would not take up the time of the members by quoting it at length, although it proved some very important facts. But this at least he might say, that, large as had been the increased shipments from Indian ports, and greatly as the export trade had been stimulated, the resources of India had not been developed proportionately with those of Mauritius, Ceylon, and Penang, where British settlers and British capital had free play, and full scope for the exercise of their enterprise and skill. It was lamentable to glance over the vast expanse of territory held under British rule in Asia, and to know that the English population was limited to a few thousands. Some of the causes which had led to the obstruction to settlements in India, which had retarded many important industrial operations, would, he hoped, be shortly removed. Then we might expect to see an increased stimulus given to the cultivation and export of many of those staple products which were so readily and cheaply obtained in India, and were so essential and so important to the trades and manufactures of Great Britain. When we saw that from small beginnings the manufacture of tea was making such favourable progress in various districts of India, and that, besides the local consumption, about three-quarters of a million of pounds were now shipped to England, this manufacture must necessarily extend. But at present tea was only a minor product of the hills. The staples of the plains had risen already to great importance, and would, when order and confidence were thoroughly restored, when internal communication was improved, when capital and British skill to direct and encourage were more common, increase still more. Even now India supplied us with one million and a half cwts. of cotton, with three and a half million cwts. of rice (and the cultivation in Arracan was largely on the increase), with one and a quarter million cwts. of sugar, spices, and condiments. Take again jute, hemp, corn, and other fibres, and these reached an aggregate of about 800,000 cwts.; oils to the extent of 73,000 cwt. came in annually from India; gums, and resins, and vegetable extracts reached 5,000 to 6,000 tons. Then there were wax and silk, and the important products of the forests, besides the dye woods and dye stuffs, such as red wood, safflower, indigo, as well as the drugs and medicinal substances, borax and saltpetre. Of that important ship-building wood teak, we imported, in 1856, 16,500 loads. Coffee was now grown in Chota-nagpore, Malabar, Travancore, and Mysore, and about $4\frac{1}{2}$ million pounds were now shipped. The average production of indigo in Jessore and other districts of Lower Bengal, was now over 100,000 maunds (of 74 lbs.), our imports from thence exceeding 71,000 cwts. A little indigo was grown in Scinde, and the culture of the plant could be extended to many other localities. Excellent tobacco was grown at Masulipatam, Rajmundry, Coimbatore, &c., although not in sufficient quantity to export. The production of opium in Patna and Benares, and in Malwa, had doubled within the last ten years. These were some of the indications of British enterprise and British industry which could not be overlooked. But the suggestions of Mr. Clarke would carry forward the work on a more rapid scale. The connection of healthy hill towns with the cities of the plains and the non-tropical districts, would necessarily draw residents to India, and give a guiding influence not only to tropical cultivation, but to the extension of our trade with Tartary and Thibet, &c., through Bhotan, Nepaul, Cashmere, Ladak, &c., by the various mountain passes. Of this interior trade comparatively little was at present known, and yet, from various data he had consulted, exclusive of Tartary it could not be set down at less than a million and a half sterling.

While we were largely indebted in our trading operations for raw materials to India, a mutual exchange was being carried on. Maize, the potato, the capsicum, and many Western fruits had been introduced into India. The mahogany, logwood, pimento, and other important trees of the new world, were now spread over the whole country, while we had drawn from the Himalayas the valuable *Pinus deodara* and other trees and plants. The vine, the apricot, the raspberry, the strawberry, the olive, the carraway-seed, and other plants grew in wild luxuriance all over the Himalayas. Vines flourished on spots almost inaccessible; and the carraway seed, whose delicious fragrance was so highly prized in Asia, grew in places where, six months in the year, the snow lay deep, about 15,000 feet above the level of the sea. The late Dr. Royle, in his "Productive Resources of India," published twenty years ago, after enumerating the varied vegetable productions of that country, referred specially to the mountains, and remarked that "though their bases are covered with a tropical and unhealthy jungle, they abound in valuable woods, have at certain elevations a delightful climate, and productions analogous to European countries. There we may soon hope to see the tea plant a thriving culture, and the hemp turned to useful account. Also, though the cold and bleak tops of these mountains, and the plains on their northern face, appear barren and unproductive, their lakes abound with borax, and their valleys with vines; and we have in addition spikenard and rhubarb from the vegetable, with musk from the animal kingdom." Since these lines were penned, very much had been done, but much more remained yet to be accomplished. Indeed, to comprehend the diversities of so wide a field, to evolve its various natural resources and to display its manifold capabilities, was a task of no ordinary magnitude, but the benefits which might be insured were more than commensurate to the difficulties to be overcome, and if only ordinary precaution were taken in suiting our measures to the objects we had in view, every fresh step would afford an advanced position from which to make further progress, so as to afford facilities to the government and benefits to the people.

Mr. Henderson said that Mr. Hyde Clarke had guarded himself from the imputation of advocating the colonisation of India in the same sense as would be understood in reference to any of our other colonies, and had had recourse to the phrase "English settlement," for the purpose of avoiding the misapprehension occasioned by the first-named term. The reasons given by Mr. Clarke for this change of expression did not appear to be sufficiently precise. Colonisation in India, whether on the hill regions or elsewhere, must be understood in a different sense from what was usually implied. What was wanted for Canada, Australia, &c., was simply labour and capital; but in India it was not labour, but skill and integrity that were required. India already possessed more manual labourers, in most localities, than she was able to give continuous or profitable employment to. The population of India was sufficiently great to turn to account the whole productive resources of that country. What she required was brain, not muscle. She needed the seeing eye and the guiding hand—not the mere brute labour, which, after all, could be supplied by a colony of chained convicts. India was the field of colonisation for the educated middle classes of England, not for the hewers of wood and drawers of water. To lose sight of this distinction was to mistake the whole question. The position of Englishmen in India must of necessity be that of a governing class; sahibs (or masters), not labourers. India was no field for English labour; the climate and the superabundance of the population precluded its introduction into that country. The thing then to be considered was, how were Englishmen of the educated class to be kept in health in India, without having recourse to the expensive system of furlough to England. Mr. Clarke saw in the solution of this problem a means of materially strengthening our hold on the Indian Empire, and very justly considered that whatever tended to such a purpose was well worthy of the attention of the people of England. To understand the difficulties in the way of establishing English settlements in India, it would be necessary to recur to the condition of the Indian Government some forty years ago, when he (Mr. Henderson) had first become acquainted with it. Previous to the year 1813, India had been sealed to all Englishmen not in the service of the East India Company. To obtain a licence to reside as a free merchant in the country, or even to enter any of her seaports as a free mariner, required as much influence and diplomacy as were now necessary to obtain a writership or a cadetship. At this time, almost the only commercial houses in India were either directly or indirectly under the management of the Company's servants, who took good care that interlopers should have no chance of competing with them. This was the era of the famous "pagoda tree," when fortunes were made in as many months as would now require years. In 1833, when the East India Company relinquished their monopoly of the China tea trade, the Indian Government also abandoned its mercantile character and the operations which they had commenced for the cultivation of tea in their own province of Upper Assam. The preliminary expenses of European supervision were undertaken by the Bengal Government for the first three years, when, on the formation of the Assam Company, the gardens and part of the establishment were transferred to it by the Bengal Government, the reports of their officers inducing the belief that a crop of two million pounds of tea would be obtained in seven years. The offer was accepted, the merchants of London and Calcutta establishing the Assam Company, with a capital of £500,000, of which £200,000 was speedily paid up, and invested in cleaning the land, granted free of rent for 20 years, and arrangements were made for the transmission of labourers from the lower provinces, two ships having been despatched from Singapore and Penang with 460 Chinese labourers, for the cultivation and manufacture of the tea. They also provided the Assam steamer, a model of which was on the table, and the Naga tow boat was constructed in Calcutta and despatched to Assam in 1840, carrying with her a saw mill. The difficulty, however, of procuring a steady supply of labour was very great, so that not one tithe of the crop anticipated was realised. A great loss was thus sustained, principally, however, from the scarcity of intelligent and energetic superintendents, and from the great mortality arising from the malaria engendered by the newly cleared forest. Had there existed at that time English settlements on the hill regions, or had adequate encouragement been given by government for emigration of the educated classes from England, there would doubtless have been little difficulty in procuring the necessary number of trustworthy superintendents. Mr. Clarke had very properly subordinated this idea of English settlements to that of improved means of communication throughout India. The railways now in progress of construction would no doubt, in the course of a few years, enable the different sanitaria and hill stations to be within easy access of the great centres of commerce and military operations; but, at present, the completion of these lines was delayed from want of adequate means for conveying the railway stores and material. The means hitherto available for this purpose were the steamers and other vessels plying on the great rivers, but the exigencies of Government, during the late crisis, had absorbed nearly the whole available means of water transport, and the railway operations had been seriously retarded. With the view of overcoming this difficulty, as well as providing for the means of communication to the eastward and southward of the Ganges, he (Mr. Henderson) had devised a system of steam tug and tow boats for general purposes, capable of being

managed by native crews, with or without steam power —models of which were on the table.

The CHAIRMAN proposed a vote of thanks to Mr. Hyde Clarke for his valuable and highly interesting paper, and expressed his regret that the time did not allow them to discuss this subject in a way that its importance deserved.

The Paper was illustrated by various maps, views, and photographs kindly lent by the East Indian Railway Company, the Madras Railway Company, the Oude Railway Company, Mr. Ewart, M.P., Mr. Wyld, M.P., Messrs. J. and C. Walker, Messrs. Kell, and Messrs. Maclure, Macdonald, and Macgregor. On the table were specimens of tea, contributed by the Assam Tea Company, and models of boats designed and lent by Mr. A. Henderson.

The Secretary announced that on Wednesday evening next, the 26th inst, a Paper by Mr. M. Digby Wyatt, "On the Influence Exercised on Ceramic Manufactures by the late Mr. Herbert Minton," would be read.

The following letter has been received by the Secretary:—

SIR,—Had other engagements permitted, I should certainly have accepted the invitation to take part in the discussion upon Mr. Hyde Clarke's paper.

As an auditor of Indian railways, I know how important an element of judgment is the financial and economical view of our Indian policy, and I venture to contribute a few considerations from that point of view.

So long as India could be regarded chiefly as a market for the sale of our wares, or for the supply of our wants, it was not within the power of the privileged corporation which Great Britain fostered, either to compromise the national honour or to commit the national resources. Now, however, that territorial rights and responsibilities have devolved upon us, and supreme government has come to be exercised on behalf of the Crown, we can no longer deal with our fellow subjects in a mere trading spirit; and if we were even warranted to consult our immediate convenience and abandon millions of our fellow men to the chaos which our rule alone prevents, we should nevertheless not dare so to debase Great Britain in the scale of nations, as to flee from that conspicuous post in the van of civilization.

How best to maintain India in peace is the question of the day. Does any observant man doubt that the rebellion might have been averted, even with the handful of European troops available at its outbreak, could railway enterprize, fostered in due season, have then afforded moderate facilities for the transit, distribution, or concentration of forces?

What an appalling picture were a balance-sheet, showing, on one side, the cost of the rebellion in blood, treasure, prestige, and progress; on the other side, the contingent responsibility in respect of a few hundred thousand pounds per annum of guaranteed interest upon railway capital during construction.

The debit side of such a balance-sheet will remain beyond the power of mere figures to express; the other side has been thus intelligently computed by the City Editor of the *Times*, a competent appraiser.

"The responsibility is simply a guarantee upon railways, and this, according to present experience, promises ultimately to be merely nominal, since the lines, while they will enormously increase the tax-paying power of the people, are likely, at the same time, to yield upon completion more than the rate of interest to which the government stand pledged."

It was a bolder policy which happily determined the construction of telegraphs in India, and we have it on no less authority than that of Colonel Sykes, ex-Chairman of the East India Company, that the telegraph has been the salvation of our Indian empire, while it has also proved a commercial success.

The cry is still—more men from England! and we are told that 50,000 men are placed in India at a cost of £100 each, *i.e.*, five millions of pounds sterling! How instructive is the problem suggested thereby. Since these men must be relieved or replaced at short intervals, because of the ravages of climate and concomitant evils, what is the capital sum which, at market rates of interest, is equivalent to the recurring cost of these periodical reliefs or replacements? And what fragment of that capital sum would suffice to open up the proposed sanitary retreat in Northern Bengal, within a few hours rail of Calcutta, where, we are told, European troops might luxuriate in a genial atmosphere, and be maintained, within call, for effective service in all emergencies; if, indeed, all emergencies need be apprehended when the native mind shall become conscious of such resources in reserve.

If Indian enterprize, as an investment, did not happen to be associated in the public mind with the guarantee of a minimum dividend of 5 per cent. (not advanced out of capital as in other analogous cases, but contributed direct from the public treasury), there would be less disposition to weigh the security offered by the guaranteeing party, *i.e.* the solvency of the Government of India prospectively.

The present market price of Indian Railway Stock, contrasted with what it used to be when money was less abundant, before the rebellion, seems to present some anomalies.

1. Then, East India Railway Stock fetched £130 per cent.; the East India House, in Leadenhall-street, being the ostensible government, one which in popular estimation, might have been left in the lurch, and perhaps ejected from India; whereas now, the corporation is already virtually superseded by the Imperial Government, and the honour and resources of the whole empire are in the face of the world committed to the maintenance of our supremacy in India.

2. Then the line opened was not yet earning the outgoings in respect of it; whereas now, its rapidly developing traffic already yields 7 or 8 per cent. net profit.

3. Then, a constituency holding until 1874 a stake in India, represented by £6,000,000, exercised a certain influence to the exclusion of all others; whereas now, the railway proprietary, interested possibly for 99 years, to the extent of some £30,000, may rest assured that if any constituency shall hereafter have a voice in Indian affairs, to them will be recorded a due preponderance for the protection of their proper interests.

4. Then, the Imperial Government was a mere creditor in respect of such advances as occasion might require, whereas, hereafter, still larger advances from the Government, in one capacity to itself, under some other name or form, must unavoidably take rank in subordination to claims of simple creditors, especially guaranteed ones.

This fourth contrast, however, moots the hair-splitting question of the extent of Imperial responsibility, for the pecuniary engagements of the Indian executive, which it (the Imperial Government) has controlled, and is about to supersede. Deliberate opinions, from those of Peel in 1842, down to those of Gladstone, Disraeli, Baring, and other authorities in 1858, might be more usefully cited here if the question seriously affected Indian railway securities. What boots it, however, to discuss, whether a bill accepted by the Indian Government does or does not convey a claim "in need" upon the Imperial treasury, so long as 7 or 8 per cent. is available already, and the Imperial treasury is becoming more and more committed to the protection of the railway, a dividend paying highway, to an extent far in excess of the minimum of interest guaranteed.

Occasionally consulted upon the relative merits of investments, as such, my attention has been naturally directed to the swollen currents of floating capital, which continue to congest the ordinary channels, and prevent a healthy rise in the rate of interest. This is a common sequence of every monetary crisis, and unless a due appreciation be induced of legitimate British enterprise, we shall soon be drawn into a vortex of wild speculation, with its inflated promises and demoralizing results. Nay, even with reference to foreign governments, which find it expedient to pay dividends through good or through evil report, may we not demand whether the same capital, which, if buried in Russia or like soils, might, as in the fable, spring up armed men, must not, if employed in developing the magnificent resources of our own Indian empire, conduce to results at once conciliatory and civilizing, profitable and reproductive of occasions for profit, as well as conversive of what were else a drain upon our resources, into a noble element of the national strength.

I am, &c.,

J. A. FRANKLIN.

9, Warnford-court, 17th May, 1858.

SOUTH KENSINGTON MUSEUM.

During the week ending 15th May, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,098; on Monday and Tuesday (free evenings), 4,262. On the three Students' days (admission to the public 6d.), 924; one Students' evening, Wednesday, 136. Total, 9,420.

Home Correspondence.

THE SEWAGE QUESTION.

SIR,—As an exhibitor of new apparatus at the Society of Arts, to manage and utilise sewage on a new principle, I was anxious, at the last meeting of the Society, to draw attention to the model on the table, and several drawings illustrating its principles and mode of operation. I was, however, so satisfied with the turn the discussion was taking—tending to show that the whole system at present rests upon wrong principles—that I contentedly waited until it was too late to enter upon anything like a clear explanation.

In opening the discussion, Lord Ebury remarked upon the unsettled and unsatisfactory state in which the whole question was still left, after the last as well as all the reports and investigations on the subject, noticing particularly the term employed by Mr. Baker, the reader of the paper, to the effect that we were still "hammering at" a plan. Most of the succeeding speakers took much the same view, complaining that there was nothing to "go upon" in the new Report of the Royal Commission, and that the whole question required to be discussed and examined again *ab initio*, in which I fully agree.

Another observation made by his lordship touches, I think, upon the very point upon which the re-discussion should take place.

In explaining the reasons why the nuisances so much complained of had not been more rapidly and successfully abated, he observed, that until even a recent period the duties of the authorities were strictly "to prevent all sewage matter from getting into the sewers," and not to consider how best to send it through them. Now it is to this point, I think, we must return at last; in fact, to the consideration of whether this great change was a wise and beneficial alteration or not. *Nulla vestigia retrorsum* may be a good motto in heraldry, but in more practical matters it is a very dangerous one; in all cases when a false move has been made, the sooner it is backed out of the better, according to all experience.

Now, I am perfectly convinced, and have been so for some time, that a gross error was committed in that change. With all its *désagrémens*, I think it was at least a safer plan than the present one, which indeed seems to be attended with quite as much nuisance, and is certainly more complained of, and that not without reason. If, however, it can be shown that all the inconvenience and nuisance attending the removal of house-refuse can be easily and completely avoided, and even the trouble of it reduced to a mere nothing, the objections to a return to the old plan ought, in reason, to be considered as removed.

In a paper read before the British Association last year (but which there was no time to discuss), I endeavoured to prove that position, and I have since re-examined the whole subject very carefully. That paper is now published,* and all the apparatus necessary and proved to be effectual and easy of application for the purpose, may now be seen at the Society's Exhibition.† Many details of the plan no doubt remain yet to be filled up, but I believe the great principles of it have been made out, and indeed it has been proved to act satisfactorily in practice.

I am, &c.,

J. LLOYD, M.D.

Anglesea, May 17th, 1858.

MR. SANDERSON'S PAPER ON IRON.

SIR,—In reading my paper perhaps some misapprehension may arise as respects the reduction of the metalloids and the discharge of the phosphoric acid; the rationale is this—sulphate of iron being used as the flux, the oxygen of the sulphuric acid, and probably that of the protoxide of iron also, or a part of it, unites with the carbon in the pig iron, and with the metalloids, oxidising the latter into their earths, the sulphur into sulphurous acid, and the phosphates into phosphoric acid, the carbon becomes carbonic oxide or carbonic acid, most probably both, the sulphurous acid goes off in fumes, and the earths due to the oxidized metalloids pass with the phosphoric acid into the cinder. The phosphoric acid has by accident been described as volatile, at least the paper may be so understood; this, however, it is not.

I am, &c.,

CHARLES SANDERSON.

Sheffield, May 18, 1858.

Proceedings of Institutions.

HALIFAX.—The last report of the Mechanics' Institution, read at the annual meeting, at which John Crossley, Esq., presided, states that the number of members and subscribers amounts in the aggregate to 1,299, showing a large increase upon that of last year. The number of volumes added to the library, during the year has been 368, the total number being 4,285. The issues during the same period have been, of volumes, 15,275; periodicals, 3,230—total, 18,505, being an increase over the previous year of 5,525. Lectures of a superior character had been provided, but which, however, had not been very well attended. The lectures of John Abbott, Esq.; H. Phillips, Esq.; John Stores Smith, Esq.; the Rev. E. Mellor, M.A.; J. D. Hutchinson, Esq.; and the Rev. R. L. Carpenter, B.A., were all gratuitous, and to those gentlemen the best thanks of the Institution were due. The additional class accommodation provided had been fully occupied by fresh applicants for admission to the classes, on removal to the new premises. In order to perfect their organisation much time had been spent, and a large expenditure incurred, each class-room having been supplied with the appropriate school requisites. The benefit arising to the pupils by this outlay was already

* *Engineer* Office, No. 163, Strand.

† See No. 229 in the Catalogue.

perceptible, and the classes were now in an efficient condition. In order to sustain this, a considerable portion of the income of the Institution must be spent in this department. The average attendance of the classes on each evening for the year is 132. The Rev. Mr. Carpenter, Mr. Lewthwaite, and Mr. H. Foster, are gratuitous teachers. The number on the books of the female branch is, adults, 50; juveniles, 73—total, 123. These classes are taught gratuitously by Mrs. Carpenter, the Misses Stansfeld, and Miss Birtwhistle. The average attendance of the juveniles is 35, and the aggregate attendance of adults and juveniles has frequently exceeded 80. The success of the penny savings bank had outstripped the most sanguine expectations of the directors; the amount of deposits paid in during the last six months being £1,643 10s. 6½d., and the amount of interest allowed, £28 16s. 9d. The present number of pass-books out is 4,167, and there are no fewer than 3,100 open accounts. Notwithstanding the munificent donations made to the Building Fund, there is still a considerable debt remaining upon the Institution, but the directors observe that seldom has there been such a cordial union of all parties in the community to recognise the claims of a public Institution; and seeing that, to such a large extent, public sympathy has been enlisted, they do not despair of the entire removal of the debt at no very distant period.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Geographical, 1. Anniversary.
Linnæan, 1. Anniversary.
TUES.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Meteorological, 7. Anniversary.
Med. and Chirurg., 8½.
Civil Engineers, 9. President's Conversazione.
WED. ......Geological, 8. Mr. Harkness, "On Jointings and Dolomites near Cork." Mr. Prestwich, "On the Westward Extension of the Raised Beach of Brighton." Dr. Bigsby, "On the Palæozoology of the Strata of New York."
Society of Arts, 8. Mr. M. Digby Wyatt, "On the Influence exercised on Ceramic Manufactures by the late Mr. Herbert Minton."
Archæological, 8½.
THURS. ...Numismatic, 7.
FRI.........United Service Inst., 3. Lieut.-Col. E. Wilford, "On the Qualifications necessary for an Infantry Soldier efficiently to use highly improved modern Fire Arms."
Royal Inst., 8½. Dr. E. Frankland, "On the Production of Organic Bodies without the Agency of Vitality."
SAT..........Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."
Medical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 7th May, 1858.

76. Bills—Bishops Trusts Substitution.
77. ——— Ecclesiastical Corporations Leasing.
Statistical Abstract for the United Kingdom, from 1843 to 1857.

Delivered on 8th and 10th May, 1858.

161. Civil Contingencies—Account and Estimate.
182. Oxford University—Copies of Four Ordinances.
183. Oxford University (Scholarships of Lord Craven's Foundation)—Copy of an Ordnance.
242. Irish Mail Contract Vessels—Return.
250. Poor Relief (Ireland)—Return.
252. Education—Return.
256. Navy—Return.
258. Barracks (Metropolis)—Return.
264. Probate Duty—Return.
265. East India (Oude)—Copies of Letters and Proclamation.
267. Victoria Station and Pimlico Railway Bill—Return.
259. Public Works (Ireland)—Account.
254. Straits of Malacca—Copies of Correspondence.
191. Education—Paper.
78. Bills—Ecclesiastical Residences (Ireland).
75. ——— Oxford and Cambridge Universities, &c., Estates.
Sewage of Towns—Preliminary Report of the Commissioners.

Delivered on 11th May, 1858.

73. Bill—Sale and Transfer of Land (Ireland).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 14, 1858.*]

Dated 8th March, 1858.

466. B. B. Stoney, Dublin—Imp. in buoys, floating beacons, and other similar floating bodies.

Dated 17th March, 1858.

542. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—Imp. in metallic canisters for holding gunpowder and other articles of a similar nature. (A com.)

Dated 24th March, 1858.

624. A. L. Thirion, Aische-en-Refail, Belgium—An improved method of transforming circular movements.

Dated 15th April, 1858.

816. F. S. Thomas, Junction-street, Kentish-town—An improved mode of propelling carriages upon railways.

Dated 20th April, 1858.

863. W. S. Clark, Atlas Works, Upper Park-place, Dorset-square—An improved cultivator tooth for agricultural purposes. (A com.)
864. R. Peacock, New Holland, Lincolnshire—Imp. in apparatus for preventing smoke in furnaces, and in effecting a more perfect combustion of fuel.

Dated 22nd April, 1858.

881. T. Hutchison, Paisley—Imp. in shawls.
885. G. Smith, Morriston, near Swansea, Glamorganshire—Imp. in the manufacture of zinc. (A com.)
887. P. Maugey, Paris—Imp. in diaphragms for optical instruments. (Partly a com.)
888. H. A. de Saegher, Brussels—A composition proper to prevent the incrustation of steam boilers.
889. W. Beck, New York—Improved machinery for weaving fringes and other fabrics. (A com.)
891. T. Harrington, Dover—Improved mode of ventilating the hold and other parts of ships.
892. J. B. Paddon, Gray's inn-road—An imp. in gas regulators.
893. J. Stocks, Berry Brow, and Charles Kaye, Lockwood, Yorkshire—Imp. in apparatuses for coupling and uncoupling wagons and carriages on railways.
894. T. Donkin, Bermondsey—Imp. in apparatus employed in the manufacture of paper, applicable also to controlling the motion of travelling webs and fabrics. (A com.)

Dated 23rd April, 1858.

895. T. Greenshields, 11, Little Titchfield-street—Imp. in purifying gas produced from coal, and obtaining ammoniacal and other alkaline salts.
897. C. Atkinson, Sheffield—A certain imp. in Venetian blinds.
898. H. J. Sillem, Liverpool—Imp. in the machinery for the manufacture of sugar.
899. J. P. Pirsson, New York, U.S.—Imp. in the condensers of steam engines.
900. W. Foster, Black Dike Mills, near Bradford—Imp. in multitubular and other boilers for the prevention of smoke and economising fuel.
901. A. Jenkin, Carrick Mines, Dublin—Imp. in furnaces for the reduction and calcination of lead, tin, and copper ores.
902. J. O. York, Paris—Imp. in obtaining power when bi-sulphuret of carbon is used. (A com.)
903. C. Lungley, Deptford Green Dockyard—Imp. in the construction of portable ships and boats, and their appurtenances.

Dated 24th April, 1858.

905. J. Maitre, Thieffrain (Aube), France—Proper apparatus for washing iron mineral.
907. R. Bodmer, 2, Thavies-inn, Holborn—An improved apparatus for removing sand and similar loose material from docks, rivers, and waterways. (A com.)
908. F. Lillywhite and J. Wisden, Coventry-street—An improved apparatus for projecting cricket balls, or other similar articles.
909. W. A. Clark, Bethany, U.S.—Imp. in expansive bits.
910. J. Horton, Ashburton—An improved construction of horse-hoe.
911. J. Lawson, Leeds—Imp. in machinery used in spinning flax and other fibrous substances. (Partly a com.)

Dated 26th April, 1858.

912. L. Newton, Oldham—Imp. in cop tubes used in spinning machinery.
913. B. Burleigh and F. L. Danchell, Great George street, Westminster—Improvements in filters.
914. J. M. Fisher, Taunton—Imp. in chimney tops or cowls.
915. J. Braidwood, Glasgow—Imp. in steam boilers and furnaces.
916. J. Westerby, Huddersfield—Improved apparatus for lubricating pistons.
917. W. Jones, Pendleton, Lancashire—Improved machinery for ringing bells.
920. J. Seaman, Britannia Iron Works, Bedford—Imp. in machinery or apparatus for effecting the working or cultivation of land, and in the means of driving the same.
921. W. Foster, Lower Tower-street, Birmingham—An improved vent-tap.
922. E. E. Lee, Birmingham—Certain improved modes of applying vitrifiable materials for the ornamentation of metal, buttons, clasps, and other articles of dress, and which said improvements are also applicable to the ornamenting of gilt-jewellery, book-clasps, and mounts, also parts of lampstands, chandeliers, and other such like articles made in dies, moulded, or formed in any other way.

923. T. Dobson, Birmingham—Imp. in machinery or apparatus for forging iron.
924. W. E. Newton, 66, Chancery-lane—Imp. in covering roofs and other parts of buildings with slate or other materials. (A com.)

Dated 27th April, 1858.

925. E. Hunt and H. D. Pochin, Salford—Imp. in the treatment and application of resins and resinous substances.
926. E. White, Bath—Imp. in facilitating reference by means of indexes.
927. E. Simons, Birmingham—Imp. in cornices and cornice poles for window and other curtains.
928. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the arrangement and construction of blast-engines, pneumatic machines, and pumping engines generally. (A com.)
929. J. Fraser, Blue Vale Chemical Works, Gallowgate, Glasgow—Imp. in the manufacture of nitrate of potass.
931. G. R. Tovell, Mistley, Essex—Imp. in the construction of ships and other vessels.
933. M. Moss, 15, Marlborough-place, Old Kent-road—Imp. in ladies' petticoats.
934. J. Hulett, Aldersgate-street—An imp. in shirt collars.
935. M. Sautter, Paris—A new and useful imp. in diving bells. (A com.)
936. W. Keiller, Dundee, N.B.—Imp. in apparatus for cutting, reducing, or dividing vegetable, animal, and other substances.
937. W. E. Newton, 66, Chancery-lane—Imp. in machinery for splitting leather or skins. (A com.)
939. J. F. M. Charpentier, 39, Southampton-row, Russell-square—A fire escape.

Dated 28th April, 1858.

940. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved apparatus for the condensation of smoke. (A com.)
941. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved saponaceous compound. (A com.)
942. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved process for combining silk with other textile subtances. (A com.)
943. B. Martin and C. J. Light, Great George-street, Westminster—Imp. in railway turntables.
944. E. Tomlinson, Manchester—Imp. in cop tubes, and in the machinery or apparatus to manufacture the same.
945. C. F. Vasserot, 45, Essex-street, Strand—An improved waterproof fabric. (A com.)
946. W. Clark, 53, Chancery-lane—Imp. in railway crossings. (A com.)
947. A. V. Newton, 66, Chancery-lane—Certain imp. in the construction of paddle-wheels. (A com.)
949. A. Winkler, Vienna—Imp. in printing or producing impressions in gold, silver, and oil-colours upon metallic plates, and in the mechanism employed therein.
950. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in furnaces for the melting and reduction of steel, copper, zinc, and other metals. (A com.)

Dated 29th April, 1858.

951. J. Martin, Barmer, near Fakenham, Norfolk—Imp. in machinery or apparatus for reducing, cutting, or pulping roots and other substances.
952. S. Bartlett, 135, Lupus-street, Pimlico—Imp. in machinery for forming gutta percha soles and uniting them to the upper leathers of boots or shoes. (A com.)
953. E. Simons, Birmingham—Imp. in ordnance.
954. A. M. Perkins, Francis-street, Gray's-inn-road—Imp. in high-pressure steam engines.
955. C. Lawrence, Honley, near Huddersfield—Imp. in steam engines.
956. R. Johanny, Vienna—Imp. in the construction of furnaces.
957. W. Smith, 18, Salisbury-street, Adelphi—Imp. in spinning machinery. (A com.)
959. D. Auld, Glasgow—Imp. in working furnaces and steam boilers, and in apparatus connected therewith.

Dated 30th April, 1858.

960. R. B. Huygens de Lowendal, 89, Chancery-lane—Imp. in the construction of springs, and for their new application to the working of machinery.
961. J. Chadwick, Manchester, A. Elliott, West Houghton, Lancaster, and W. Robertson, Manchester—Imp. in machines for twisting and winding silk direct from the cocoons, such machines being of the class commonly known as throstles.
962. J. Luis, 1B, Welbeck-street, Cavendish-square—Proper apparatus for separating two substances of different densities; among others may be mentioned pit coal from the slate which it contains. (A com.)
963. B. E. Guyot de Brun, Pantin, Rue de Montreuil, 18, Seine, France—Leather tissue and other tissues rendered waterproof by a new process.
965. E. T. Hughes, 123, Chancery-lane—An improved regulator and float combined applicable to the manufacture of paper. (A com.)
966. J. C. Faucon, Paris—Imp. in bedsteads, bed bottoms, seats, and articles for lying and reclining on.
967. J. Chapman, jun., North Foreland Lighthouse—Producing a substance entitled felted-woody-fibre, convertible into useful articles, and applicable to the internal fittings and decorations of dwelling-houses.
968. G. H. Ellis, New Malton, Yorkshire—Imp. in cleaning boots and shoes by machinery, and in apparatus for the same, which is also applicable to cleaning other articles in domestic use.
969. W. Clark, 53, Chancery-lane—Imp. in obtaining motive power, and in the apparatus connected therewith. (A com.)
970. P. A. Godefroy, 3, King's-mead-cottages—Imp. in the mode of separating vegetable from animal fibres or fabrics.
971. C. A. J. Demanet, 43, Rue de la Science, Brussels—The extraction of coals and minerals from mines.
972. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in suspension bridges. (A com.)
973. A. Smith, Mauchline, Ayr, N.B.—Imp. in valves.

Dated 1st May, 1858.

975. R. Wardell, Stanwick, near Darlington—Imp. in reaping machines.
976. R. Illingworth, Blackburn—Imp. in safety valves.
977. W. Spence, 50, Chancery-lane—Imp. in the production and application of a material called French purple, and in the process employed in obtaining it. (A com.)
978. L. Talabot, 57, Rue de la Chaussée d'Antin, Paris—Imp. in rolling railway and other bars.
979. W. Hopkinson and J. Dewhurst, Mayfield Printworks, Manchester—Imp. in apparatus for consuming smoke.
980. F. M. Gregory, Shavington, near Market Drayton—Imp. in chaff-cutting machines.

Dated 3rd May, 1858.

982. C. Schleicher, Bellevallée, Prussia—An improved machine intended to make the points of needles, pins, and all other similar articles.
984. E. S. Trower, Stansteadbury, near Ware, Herefordshire—Imp. in apparatus for treating flax, hemp, and other fibrous matters requiring like treatment.
986. J. G. Appold, Wilson-street, Finsbury-square—Improved apparatus for laying submarine telegraphic cables.

Dated 4th May, 1888.

988. J. Smethurst, Guide Bridge, Lancashire—Certain imp. in boilers for generating steam.
992. W. E. Newton, 66, Chancery lane—Improved apparatus for mixing and moulding materials for the manufacture of fuel, parts of which apparatus are applicable to moulding bricks and other analogous articles. (A com.)

WEEKLY LIST OF PATENTS SEALED.

May 14th.

2864. G. P. Wheeler.
2866. J. Macintosh.
2874. J. F. Spencer.
2878. W. Gossage.
2881. W. Pidding.
2884. R. A. Brooman.
2885. R. A. Brooman.
2888. W. H. Bell.
2892. A. F., F. O., & J. Germann
2894. R. Clegg.
2904. W. Clay.
2950. W. Blinkhorn.
2956. W. B. Taylor.
2980. J. B. Couy.
3024. W. E. Newton.
3066. C. Cowper.
3038. J. Thornton.
3102. H. Johnson.
3170. J. H. Johnson.
118. J. Brown.
342. J. Davis.
474. J. E. Poynter.

May 18th.

2895. M. Booth and J. Farmer.
2905. W. Clay.
2915. C. L. West.
2918. H. Walker, J. Beaumont, and J. Gothard.
2920. P. A. Brussaut.
2927. J. M. A. E. Fabart.
2943. R. W. J. Abbott and D. Mills.
2959. W. Elcock and S. Bentley.
3019. T. S. Adshead and A. Holden.
527. J. S. Russell.
561. A. A. Croll.
583. J. Biggs and W. Biggs.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

May 10th.

1062. J. H. Johnson.
1065. J. Steele.
1115. J. G. Butt & J. A. Martin.
1134. T. Piggott.

May 11th.

1091. R. S. Newall.
1098. W. Fawcett, J. Lamb, and F. B. Fawcett.

May 12th.

1070. G. Robinson.
1083. W. Robertson.
1089. J. Mason, S. Thornton, and L. Kaberry.
1123. E. Morewood & G. Rogers.

May 13th.

1085. R. McConnel.
1087. J. Buchanan.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4088	May 18.	Portable Combination Chair Stool, &c	Levi Stead.....................	97, Norton street, W.
4089	„ 19.	Fruit and Blossom Protector	Joseph F. Meston	Mundford, Norfolk.

Journal of the Society of Arts.

FRIDAY, MAY 28, 1858.

ARTISTIC COPYRIGHT.

A Petition to the House of Commons, praying for an Amendment of the Law of Artistic Copyright, is now lying for signature at the House of the Society of Arts. Members and others interested in the subject are requested to call in the course of the ensuing week, to sign the Petition.

WRITING CASE.

The Council regret that, after a careful examination by the Committee specially appointed to report on the merits of the sixty-two writing cases sent in to compete for the Special Prize of Twenty Pounds and the Society's Silver Medal, there are none which show sufficient merit to justify the Council in awarding the Prize. The Council have decided to invite further competition, and will shortly be prepared to announce the conditions.

LOCAL BOARDS—PREVIOUS EXAMINATION.

Fifty-seven Local Boards of Examiners have been formed. Returns of the Candidates who have passed the Previous Examination have been received, as follows :—

Louth	4
Wigan	6
West Hartlepool	3
Leeds (Christian Institute), No. 1.	14
Northowram	1
Portsmouth	2
Warminster	1
Banbury	2
Macclesfield	83
Newcastle-on-Tyne	3
Lymington	1
West Brompton	4
Leeds, No. 2.	10
Wakefield	4
Pembroke Dock	4
Ipswich	6
London Mechanics' Institution	8
Manchester Mechanics' Institution	32
Selby	9
Bradford	18
Halifax, No. 1.	15
Salisbury	1
Liverpool	35
Lockwood	1
Halifax (Working Men's College), No. 2.	21
York	7
Berkhampstead	19
Bristol	11
London Domestic Mission	1
Royal Polytechnic Institution	28
Birmingham, No. 1, (Messrs. Chance's Reading Room)	2
Sheerness	1
Sheffield (People's College), No. 1	15
Sheffield (Mechanics' Institution), No. 2	3
Blackburn	5
Crosby Hall (London) Evening Classes.	25
Windsor and Eton	10
Greenwich	1
Institutional Association of Lancashire and Cheshire	100
Lewes	2
Brighton	3

The total number of Candidates who have been examined by the Local Boards, is 1,108.

The number of Candidates whose names have been returned as desiring to attend the Final Examinations, is 337.

The Final Examinations, under the supervision of the several Local Boards, commenced on Monday last, and will conclude on Saturday next. A large number of the papers worked by the Candidates have already been received, and the awards will be made by the Society's Central Board of Examiners at the earliest possible date.

EXAMINATIONS.—PRIZES FOR 1858.

The following Prizes are offered to the Candidates, viz. :—

One First Prize of £5, and one Second Prize of £3 in each of the 26 subdivisions of the subjects of Examination.

No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

The Prizes will be given in money or in books, at the option of the Candidate.

The following Prizes are offered to the Local Boards, viz. :—

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than ten) bear the largest proportion to its whole number of Candidates. —One Prize of £10.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than eight) bear the largest proportion to its whole number of Candidates. —One Prize of £8.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than six) bear the largest proportion to its whole number of Candidates. —One Prize of £6.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than four) bear the largest proportion to its whole number of Candidates. —One Prize of £4.

No Local Board can receive more than one of these Prizes.

These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best, for the promotion of the objects for which it was instituted.

SURGICAL INSTRUMENT COMMITTEE.

The Council have appointed a Committee to investigate the subject of Mechanical Contrivances applied to Medicine and Surgery—to promote improvement in their production—to determine and make known desiderata—to examine and report on the merit of apparatus submitted; and to recommend rewards for successful invention.

The Committee consists of the following gentlemen, with power to recommend other names to the Council:—

*Henry W. Acland, M.D., F.R.S.
Neil Arnott, M.D.
Thomas John Ashton, M.R.C.S.
*C. Metcalfe Babington, F.R.C.P.
A. Whyte Barclay, M.D.
Lionel S. Beale, M.B. Lond.
Thomas Bell, F.R.C.S., F.R.S.
*Charles Brooke, F.R.S.
Frank Buckland, M.A., M.R.C.S.
George Budd, M.D., F.R.S.
George Busk, F.R.C.S., F.R.S.
*Samuel Cartwright, Junr., M.R.C.S.
*Thomas King Chambers, M.D.
*William D. Chowne, M.D.
*Wm. Coulson, F.R.C.S.
*George Critchett, F.R.C.S.
*T. Blizard Curling, F.R.C.S., F.R.S.
J. E. Erichsen, F.R.C.S.
Conway Evans, M.D.
*William Farr, M.D.
*William Field.
John France, F.R.C.S.
John B. Fletcher.
Robert Temple Frere, F.R.C.P.
George Gulliver, F.R.S.
*Francis Seymour Haden, F.R.C.S.
Mitchell Henry, F.R.C.S.
William Aug. Hillman, F.R.C.S.
William Jenner, M.D.
George Johnson, M.D.
Henry Charles Johnson, F.R.C.S.
W. Senhouse Kirkes, M.D.
Edwin Lankester, M.D., F.R.S.
*Henry Letheby, M.B. Lond.
James Luke, F.R.C.S.
John Marshall, F.R.C.S., F.R.S.
William Allen Miller, M.D.
Campbell De Morgan, F.R.C.S.
*Robert Nairne, M.D.
Richard Partridge, F.R.S., F.R.C.S.
Alfred Poland, F.R.C.S.
Richard Quain, M.D.
Francis Ramsbotham, M.D.
Theophilus Redwood.
G. Owen Rees, M.D., F.R.S.
Samuel J. A. Salter, M.B.
Henry Savage, M.D.
Francis Sibson, M.D., F.R.S.
John Simon, F.R.C.S.
Alfred Smee, F.R.C.S., F.R.S.
John Snow, M.D.
*Edward Solly, F.R.S.
Samuel Solly, F.R.C.S., F.R.S.
Charles Spooner.
Peter Squire.
*John Stenhouse, LL.D., F.R.S.
*Richard William Tamplin, F.R.C.S.
Alfred Swaine Taylor, M.D.
Theophilus Thompson, M.D.
John Tomes, F.R.S.
Joseph Toynbee, F.R.C.S., F.R.S.
James Reeves Traer, M.R.C.S.
Prof. Tyndall.
Charles Vasey, L.F.B.S. Glas.
*Thomas Watson, M.D.
Charles West, M.D.
*A. W. Williamson, M.D.
W. H. Winchester, F.R.C.S.

* Members of the Society of Arts.

On Tuesday last, the 25th inst., this Committee held their first meeting, at which twenty-eight members were present. Mr. C. Wentworth Dilke, the Chairman of the Council, opened the proceedings by explaining at considerable length the objects of the Council in appointing the Committee.

Mr. Dilke, in the course of his address, observed that the present Committee was one of a series established to watch and report on the continued progress of every Art represented in the Exhibition of 1851, and that its present reorganisation had especial reference to a more complete illustration of the subject in any future exhibition. The price of surgical instruments in this country was, he had been informed, considerable, in comparison with the productions of France, and though it might certainly be said that English instruments had an advantage in temper and quality, the question was, whether this advantage was commensurate with the great difference of price. The Council, in nominating this Committee, had endeavoured to include persons eminent in every branch of the profession, so as to afford material for the formation of special sub-Committees, which should each consist of at least three or four gentlemen. It appeared to the Council that the first especial duty of these sub-Committees would be to make a complete classification of the instruments and appliances at present in use in each branch of the profession, so as completely to illustrate the subject, and serve as data for future proceedings. The Council, in inviting the Committee to act, had thought it advisable to reprint and circulate amongst the members the epitome which had been prepared by a member of the Committee for the use of the staff of the Exhibition of 1851, which, however, the Council were fully aware, was imperfect, and merely suggestive. The Council were of opinion that the publication of a classified list would be in itself of great importance, and would tend to the more perfect representation of this branch of industry in any future Exhibition. It would also be the duty of the sub-Committees to examine apparatus submitted for approval, and report to the General Committee upon their merits. The sub-Committees would also have to determine desiderata, and to suggest to the General Committee the offer of rewards for successful inventions, or simplifications of existing instruments. It would now be the duty of the Committee to elect their chairman, and such vice-chairmen as they might deem necessary.

The Committee then unanimously elected James Luke, Esq., Chairman, Dr. Watson, Dr. Budd, Henry Charles Johnson, Esq., and Richard Partridge, Esq., Deputy-Chairmen, and Francis Seymour Haden, Esq., and Mitchell Henry, Esq., Reporters. The Committee then took into consideration the appointment of Sub-Committees

On General Medicine.
General Surgery.
Dental Surgery.
Obstetric Surgery.
Ophthalmic Surgery.
Orthopædic Surgery.
Philosophical Apparatus applied to the investigation and treatment of Disease.
Veterinary Surgery.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 26, 1858.

The Twenty-Fourth Ordinary Meeting of the One Hundred and Fourth Session was held on Wednesday, the 26th inst., Henry Thomas Hope, Esq., in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Binns, Richard William	Snowball, Joseph
Branthwaite, Harrison	Stickney, John, Jun.
Brown, William	Wilson, William
De Mora, J. J.	White, Henry

Wood, Nicholas.

The Paper read was—

ON THE INFLUENCE EXERCISED ON CERAMIC MANUFACTURES BY THE LATE MR. HERBERT MINTON.

By M. Digby Wyatt.

In an insular country of limited extent, such as England, with an already large and rapidly increasing population, it will be probably conceded that the man who creates any new industrial resources must be a national benefactor. His contributions to the common stock of prosperity are no less essential to the well-being and consequent tranquillity of the state than are those levied by the course of public exigencies from the highest political functionaries, or the most philanthropic lawgivers. The wisdom, energy, courage, and devotion of the great soldier or sailor may defend a nation's prosperity, but it is only by an unintermitting exercise of the very same qualities on the part of its chief industrial organisers, that the prosperity which it is the privilege of the brave defenders of a country to protect, can be made to exist. This being the case, it is to be regretted that while in Great Britain national dignities and honours are ungrudgingly lavished on other celebrities, no laurels should be reserved for those whose abilities and energies in many instances have given bread to thousands who, but for them, would have gone to swell the squalid ranks of misery, if not of crime.

What the State leaves undone in this matter, it is the duty of the intelligent middle classes to supply, and hence it is that I feel justified in asking your indulgent attention this evening to my endeavours to depict the successful labours of the late Mr. Herbert Minton, whom it would be altogether unjust, as I conceive, to exclude from the honoured list of national benefactors.

There is probably no one here present unacquainted with the name of Minton, or ignorant of the branch of industry he did so much to elevate; few, however, are, I imagine, conversant with the exact nature of what was effected through his instrumentality. All products introduced into general use, and supplied through thousands of different retail channels, become merged, in the popular idea, into one common stock; and while all may observe a progress more or less rapid in any special branch of industry, scarcely any pause to note the details of the manufacture, or to trace the originators of the successive modifications they can scarcely fail to observe. In order to lead you to an approximate estimate only of what the nature of the improvements effected during Mr. Minton's career really was, I must ask you to cast a rapid glance over the history of British Ceramic Manufacture previous to the year 1788, in which the late Mr. Minton's father established those works at Stoke-upon-Trent, in Staffordshire, which have become so celebrated under the energetic management of his son and successors.

The early stages of ceramic manufacture in England were marked by no great originality. In the production and ornament of porcelainous or semi-transparent wares, very shortly after the year 1700 great excellence was attained on the Continent, at Meissen, Moscow, St. Cloud, Höchst, Doccia, and Chantilly; and although some evidence exists of the contemporaneous establishment in this country of the manufactories at Bow and Chelsea, a corresponding degree of excellence does not appear to have been attained in them at so early a date. It was during the period between the years 1750 and 1765, that the Chelsea factory, with its soft and semivitreous paste, most successfully rivalled the great establishments of Vincennes (subsequently Sèvres), and Dresden. George II. was a liberal supporter of it, causing workmen, artists, models, and even materials to be procured from Saxony and Brunswick. In 1763 a magnificent service, the cost of which was no less than £1,200, was made for the King and Queen, under the superintendence of a foreigner, a M. Spremont, who directed the works for many years. On his retirement, about 1765, the manufacture was abandoned in London, and the principal workmen betook themselves to Derby, where an establishment had been set up in the year 1750, by a Mr. Dewsbury. In the following year a rival sprang into notice at Worcester, in the person of Dr. Wall, with whom a triumphant course of ingenious originality may be said to have been inaugurated in England. His principal invention is believed to have been that of printing on biscuit.

Up to the year 1768 no porcelain capable of bearing an extraordinary heat, and so hard as to resist scratching with a steel point, had been made in this country, for want of those materials which had, prior to that date, been discovered on the Continent, in Saxony, at Aue, by Böttcher, and in France, at St. Yrieix, by Madame Darnet. In the above-mentioned year the discovery of Cornish kaolin and pegmatite, by Mr. Cookworthy, of Plymouth, introduced a new element into the manufacture, and hard china was speedily made in considerable quantities at Worcester. From this parent establishment several others branched off, the most important probably being the Caughley Works, near Broseley, Shropshire, which were directed by John Turner, who joined them from Worcester, and who is stated to have discovered the art of printing in blue on china in 1780. It was under John Turner that Mr. Herbert Minton's father was brought up.

Such was the general aspect of the porcelain trade in England prior to 1788, and it remains to trace what had been done in the opaque earthen and stone wares. From a very early period pottery was made in Britain, and the art never appears to have been altogether lost. In the reign of Elizabeth, some dexterity was acquired, and specimens are extant evidently made of slip or clay brought into a fluid condition and cast into moulds. The Staffordshire "tigs" or drinking cups certainly abounded in her reign, and much rude pottery was subsequently produced from local plastic clay, occasionally ornamented with pipe clay patterns, and glazed with a coarse lead glaze. A great improvement on this common pottery was effected, about the end of the seventeenth century, by the brothers Elers, natives of Nuremburg, who discovered, at Bradwell, near Burslem, some fine red clay, with which they made a rude but close-grained Samian ware, which they ornamented with raised patterns, formed in copper stamps and glazed with a salt glaze, which they are believed to have been the first to introduce into England. The secrets of these Germans were discovered through a stratagem, by a man of the name of Astbury, and the foreigners were speedily ejected through local jealousies. To Astbury's son is accorded the merit of the discovery of the use of calcined flint in combination with clay, in the year 1720, and from that period commenced the manufacture of cream-coloured, buff, and dingy-white, stoneware—destined to speedily assume an altogether different and superior aspect under the master handling of the celebrated Josiah Wedgwood, who was born in 1730, and who died in the year 1795. He first set up in business in a very humble way at Burslem, in Staffordshire, in the year 1759, and the value and speedy popularity of the inventions he made within a few years of that date, supplied him, in 1771, with the means of founding his celebrated establishment at Etruria. The wares of Wedgwood are so well and generally known that it is unnecessary to dwell upon them. It

may suffice to remark that they were produced in great abundance and largely exported previous to the year 1788.

In spite, however, of various ingenious efforts, which cannot now be even enumerated, little that was good was produced in any considerable quantity previous to the close of the eighteenth century, excepting by the establishments of Bow, Chelsea, Derby, Worcester, Caughley, Leeds, Wedgwood and Spode, the latter through his judicious use of calcined bones and felspar, obtaining an enormous business in common but very good earthenware.

We shall now proceed to trace the development of the commercial house which the late Mr. Herbert Minton mainly raised into its present great importance. His father, Mr. Thomas Minton, who was a native of Shropshire, was brought up at the Caughley Works, near Broseley, as we have already observed, as an engraver. He then went to town and worked for Spode, at his London house of business in Lincoln's-inn-fields. In 1788, he came to Stoke, and bought land belonging to a Mr. Hassall, and built a house and works on the site, which has since become so celebrated. He entered into partnership, in 1790, with Mr. Joseph Poulson, who had been manager at Mr. Spode's works, which were at that time the principal in Staffordshire. The firm was joined, in 1793, by Mr. Pownall, who quitted it in 1800. Mr. Poulson died in 1809, leaving Mr. Thomas Minton alone to conduct the business. His second son, the subject of our present notice, was born on the 4th of February, 1793, in his father's house, which was then on the banks of the Trent. Up to the year 1798, earthenware alone had been made at the Stoke Works, and the staple of the business consisted of white ware ornamented with blue, in imitation of common Nankin, and in that branch of production the abilities and experience of Mr. Thomas Minton as an engraver had acquired for the firm a good commercial reputation. Mr. Herbert Minton was educated at Audlam School, in Cheshire. The manufacture of semi-transparent china was commenced in the year 1798, but owing to its proving unprofitable, that department of production was abandoned in the year 1811, to be resumed about 1821. In 1817, Mr. Herbert Minton and his elder brother, who subsequently entered the Church, were admitted into partnership with their father. About 1825, a marked improvement was effected in printed earthenware, both in the body, which was made whiter and purer, and in the glaze, in which borax, to a great extent, took the place of lead. Owing to family circumstances, Mr. Herbert Minton nominally retired from the firm, during the years from about 1823 to 1836, when, on his father's demise, he succeeded to the business; his brother having left the business to enter the Church, about the year 1821. Shortly after his father's death, Mr. Herbert Minton admitted Mr. John Boyle as a partner, who remained for about five years, and then joined the firm of Wedgwoods. Mr. Boyle's place at Stoke was taken by Mr. Michael Hollins. The last phase of the firm, for about ten years previous to Mr. Minton's demise, consisted of Mr. Minton and his nephews, Mr. Hollins, and Mr. Colin Minton Campbell. The business now remains in the hands of the two last named gentlemen.

Mr. Herbert Minton's industrial career, as assistant and principal, may be looked upon as extending over some fifty years of the present century, a period hitherto without a rival in the great history of civilisation—one of social progress and commercial development, of restless energy of thought and untiring labour, crowned by innumerable conquests of mind over matter. Of that apparently inexhaustible activity, intellectual and physical, which has formed the dominant characteristic of the past half-century, Mr. Minton offered a perfect type, and it was rather through this element than any other that his influence was so powerful as a stimulant and fertiliser. Neither a man of profound research nor an educated artist, neither an economist nor an inventor, by courage and ceaseless energy he brought to bear upon the creation of his ultimately colossal business, such a combination of science, art, organisation, and invention as can be paralleled only by that rare union of qualities which impressed the stamp of genius upon his great predecessor, Josiah Wedgwood. A clear head, a strong body, rare powers of endurance and observation, a cool judgment in spite of a singularly sanguine temperament, a kindly nature, and genial manner, were the leading characteristics of Mr. Minton; and with such natural gifts, and an amount of perseverance to which I know no parallel in history (excepting, perhaps, that displayed by the celebrated potter, Bernard de Palissy), he was enabled to benefit his country while building up his own fortune, and to do credit to the age in which he was born, thereby winning lasting honour for his memory.

Fifty years ago, Mr. Thomas Minton's establishment at Stoke gave employment to just about fifty hands, and at the date of his son's death upwards of 1,500 were in active occupation. It has been estimated by that distinguished authority, M. Leon Arnoux, that the value of our exports of ceramic manufactures, which amounted to £573,000 in 1840, cannot be now valued at less than £2,500,000, having more than quadrupled in the interim. To that rapid development Mr. Minton's activity largely contributed; and we shall now proceed to examine, in some little detail, the various branches in which he most strenuously aided, viz.:—

1. Earthenware and ordinary soft porcelain.
2. Hard porcelain.
3. Parian.
4. Encaustic tiles.
5. Azulejos, or coloured enamel tiles.
6. Mosaics.
7. Della Robbia ware.
8. Majolica; and
9. Palissy ware.

As opportunities occur occasion will be taken to elucidate the remarks made on each section, by reference to the beautiful and very valuable collection of specimens kindly exhibited by Messrs. W. P. and G. Phillips, of Oxford-street and Bond-street, at present trading under the style of Chamberlain and Co.; and also by a few novelties forwarded from Stoke to the Museum of the Department of Science and Art. Mr. Hews, Messrs. Minton's superintendent at Albion-wharf, London, has also kindly selected and arranged, for our information, abundant materials for the illustration of the sections of encaustic tiles—Mosaic, Azulejos, and Della Robbia ware.

In the first place, then, it may be observed, that Mr. Thomas Minton's efforts and attention were limited to the improvement of earthenware and soft porcelain, to which the trade of the firm was almost exclusively confined until about 1830, the remaining branches having been all originated under the auspices of his son and his son's partners. Although the firm had closely followed the excellent practice of the great Staffordshire houses of Spode and Davenport, and had succeeded in vastly improving the aspect of blue printed earthenware, and manufacturing good current porcelain, for the most part in the style of old Derby, it was not not until the above-mentioned year (1830) that any aristocratic patronage and attention were bestowed upon the house and its productions. It is still told with unction by the old workmen, how Mr. Thomas Minton was, like his son, a zealous patriot and good conservative; and that how, when the Duke of Wellington took a tour, with a brilliant suite, in the manufacturing districts, and made an entry into the town of Stoke, with the Duke of Sutherland, with whom he had been staying at Trentham, Mr. Minton turned out with all his workmen, and welcomed the hero of Waterloo as such a hero should be welcomed. The heartiness of the proceeding so pleased the ducal visitors that they ordered the carriages to stop, and went over the manufactory, much to the delight of the work-

men. From that day forward a friendly and genial interest was taken in the progress of the establishment by the Duke and Duchess of Sutherland, whose example was speedily followed by Lord Harrowby, Lord Crewe, and many others of the nobility. The excellence of the bodies, glazes, gilding, and colours of the old establishments of Bow, Chelsea, Derby, and Worcester, left but little room for novelty and improvement, so far as excellence is concerned, to the Staffordshire manufacturers. The only path open to them was by greater economy in every process, and by carefully recognising and discriminating the talents of their workpeople, to endeavour to convert the class of goods which had been previously of altogether exceptional demand and production, into objects of ordinary commercial supply and demand. So far Mr. Thomas Minton certainly succeeded, leaving it to his son to rival, and indeed surpass, the models he had been content to follow at some distance. After the year 1825, when the Derby manufactory began to decline rapidly, many skilful workmen joined the Stoke Works, and the class of goods involving artistic decoration rapidly improved. Among the best painters employed by Mr. Minton at that time were Steele, Bancroft, and Hancock, in fruit and flowers.—Mr. John Simpson held the position of principal enamel painter of figures and the highest class of decorations from about 1837 to 1847, when he came to town to take charge of the department of enamel painting on porcelain at Marlborough House. Mr. Samuel Bourne remained as chief designer to the firm until 1848, when the growing importance of Schools of Design effected a change. The lead was then taken by M. Jeannest, until his lamented death; and here I should note Mr. Minton's deep appreciation of M. Jeannest's rare capacity as an industrial artist. Often and often he has acknowledged to me the especial obligations he felt himself under, both to M. Jeannest and to his friend and best counsellor, M. Arnoux. M. Carrier, a very clever sculptor, was subsequently employed to design many graceful objects; and M. Protât, well known through the part he took in the splendid sideboard, for which M. Fourdinois gained his Council Medal at the Exhibition of 1851, is now the principal modeller. No less than fourteen of Mr. Minton's *employés* received medals and other rewards at the late Paris Exhibition. After the troubles of 1848 in France, Mr. Minton was so fortunate as to secure the co-operation and services of M. Leon Arnoux, a gentleman who had long enjoyed the reputation of being perhaps more profoundly versed in the mysteries of ceramic manufacture than any other *savant* in France. To that gentleman's zeal and ability, and the heartiness with which he entered into his principal's views, as well as the taste with which he realised them, Mr. Minton is indebted for a large share of the brilliant success of the efforts made by the firm for the Universal Exhibitions of London in 1851 and of Paris in 1855. A marked improvement also took place in the whiteness and transparency of the porcelain body, the beauty of the lustrous glaze, the purity of colours previously but imperfectly realised, such as carmine purple, bleu turquoise, gros bleu, bleu de Vincennes, pomme vert, rose du Barry produced by combinations of gold with salts of ammonia, and others. It is but just to remark here how warmly the production of this last-named tint, by Messrs. Rose, of Coalbrookdale, for Mr. Daniell, of Bond-street, was received at the Great Exhibition. The class of painting, too, was raised from the mannerism of work done by the dozen into that suited for objects designed to rise from ordinary utilitarian use into "morceaux d'amateurs," or choice ornaments worthy of the cabinets of collectors.

It may be well here to note how useful an element of social economy is to be found in the education of the workman, requisite to produce such porcelain as Mr. Minton lately caused to be decorated in vast quantities. Wages alone form an item of nearly sixty per cent. upon the cost of production of such objects, whereas for ordinary fairly decorated earthenware, they would scarcely enter for one-half that rate. Hence the amount of employment afforded, and the comparative well-being of the workman.

An amusing illustration of the widely-spread reputation Mr. Minton's wares acquired for strength and soundness of manufacture, has been mentioned to me by one of the officers of this Society. On the occasion of one of the exhibitions of English manufactures, one of Pickford's carmen was delivering a lot of china at the entrance, and on his transferring it rather rudely from his waggon to the hall-floor, the officer naturally remonstrated, when the man replied, "Oh! never fear Sir; it's Minton's—it won't break."

As the members of the Society of Arts had an opportunity of judging of his rare knowledge and capacity, when M. Arnoux delivered, in this room, his able lecture on the results of progress in ceramic art manifested in the Great Exhibition of 1851, I need not say with what respect his verdict as to the credit due to Mr. Minton, for his products in fine and highly-decorated porcelain, exhibited in Paris in 1855, should be received.

M. Arnoux observes, in his Report to the Board of Trade, after briefly describing some of the leading features of Mr. Minton's exhibition, that:—"As Mr. Minton has obtained these magnificent results by his own unaided efforts, and at his own pecuniary risk, many persons do not hesitate to award as much credit to them as to the manufactures of Sèvres, which have required the co-operation of a large number of talented men, as well as of unlimited State funds. It was a piece of good fortune to Mr. Minton that both he and the Imperial Manufactory should exhibit, at the same time, vases of the old Sèvres design, because the advantage was, in some instances, upon his side, as his coloured grounds are quite pure, and his gilding brilliant and substantial."

M. Arnoux thus further vindicates the peculiar class of "body" out of which the English porcelain is almost entirely made, in contradistinction to the usual hardware or kaolin and petuntse bodies of the continent, which last are entirely composed of infusible China clay, or decomposed felspar and a fusible flux, both materials existing in a normal form in nature.

"Certain very particular amateurs bring an objection against British porcelain, and say, that as it has phosphate of lime for its basis instead of being composed entirely of pâte frittée, it has no claim to be called pâte tendre. This objection appears to be nearly groundless. The chief beauty of the pâte tendre consists in the complete amalgamation of the colours with the glaze, and also in its capability of receiving certain tints which cannot be applied to any other kind of porcelain, such as turquoise blue, emerald green, and rose du Barry. If our porcelain combines these qualities in the highest degree—if its whiteness and transparency have been increased by the employment of phosphate of lime, who has any reason to complain? Our productions possess all the advantages of the old porcelain, and have, in addition, several accessory ones; we shall, therefore, do wisely to uphold this manufacture, since it brings us nearer to perfection."

We now proceed to the second branch of our subject, the hard porcelain manufacture, which, though through the discoveries of Cookworthy, extensively manufactured for a time, had been altogether abandoned in this country for the compound body just alluded to, until the year 1839, in which Mr. Minton, in conjunction with Dr. Turner, took out a patent for its manufacture.

The plan proposed, however, was not carried beyond a series of experiments until 1849, when, with the assistance of M. Arnoux, Mr. Minton resumed the attempt to make a body infusible, at very high temperatures, and of elements so pure as to be unaffected by ordinary chemical solvents. The renewed experiments succeeded so well, that in 1851, vessels for the laboratory were exhi-

bited by Mr. Minton, and pronounced by judges to be superior to the Meissen and Berlin wares of the same description, which had previously entirely supplied the English demand, amounting to little less than £60,000 worth annually. The result was most favourably reported on by the Duke of Argyll, President of the Jury of Class XXV. at the Great Exhibition of 1851, who stated that Mr. Minton's crucibles and capsules were subjected by Mr. Henry, at the instance of the jury, to the severest chemical tests, along with specimens from Dresden, and were found to stand those tests with perfect success; and that, besides being fully equal to the German ware in quality, they had the additional merit of being considerably cheaper. The jury, therefore, looked upon the successful establishment of this manufacture in England as a matter of much importance and interest in a scientific point of view.

We now arrive at the third section of our subject, the manufacture of "Parian," the well known material in which a very fair imitation of marble has been attained. There has been considerable discussion with respect to the rival claims of the houses of Copeland and Minton to the origination of this material, and the jury of 1851, after receiving statements from both firms, deduced therefrom, that "whichever party may have actually been first in publicly producing articles in this material, both were contemporaneously working with success towards the same result." On these grounds, as well as on their conviction that all of those bodies, respectively known as Parian, Carrara, and statuary porcelain, were but modifications of that which had been long known, and applied to the same department of art under the name of biscuit, the jury declined to adjudicate between the claimants. They, however, fully appreciated the value of the material and its probable salutary influence on public taste. My own impression certainly is, that as a manufacturing invention, after the Sèvres and Dresden biscuit, and Wedgwood Jasper, there was but little merit in the introduction, but as a commercial idea it was, unquestionably, most happy and well timed; and I am inclined to receive with great respect the statement of Mr. Robert Hunt, that this idea originated with Mr. Thomas Battam, the well-known and able artist directing the extensive porcelain manufactory of Mr. Alderman Copeland, at Stoke-upon-Trent, in the commencement of 1842. "After a series of experiments he succeeded in producing a very perfect imitation of marble, both in surface and tint. One of the earliest specimens was submitted to the Duke of Sutherland, who expressed his unqualified admiration of the material, and his high appreciation of the purposes to which it was being applied, and became its first patron by purchasing the sample submitted. This was on the 3rd of August, 1842, a date which marks a memorable event, as the commencement of a trade now not only of large commercial advantage to the potteries generally, but, fortunately, of a class that has most materially advanced the artistic state of English ceramic manufacture."

From the first launching of the material, a lively competition sprang up between the firms of Copeland and Minton, and to both it unquestionably proved a source of increased profit and extended reputation. It was also most useful in two ways—in teaching the public eye to recognize pure beauties in graceful form divested of any possible vulgar glitter, and in attracting to the potteries a class of artists such as had not found employment there since the days of Wedgwood.

The manufacture is one of much difficulty, as not only is great care necessary in fitting the various parts together, each object being moulded in several pieces, which are united and dried and then exposed to successive firings, but much judgment and experience are requisite in drying and firing, as in these operations they frequently shrink to three-fourths of their original size.

Mr. Minton introduced various modifications into the process at first adopted at his works, and succeeded in reducing the shrinkage from one-fourth to one-fifth. To the members of the Society of Arts, who must recal the successive brilliant displays presented at their Exhibitions of 1847-8, and 9, by the firms of Copeland and Minton, as well as their efforts in 1851 and 1855, it is unnecessary to dwell further upon the results respectively attained. We pass, therefore, fourthly, to that branch of our subject in which Mr. Minton's individuality shone most conspicuously, viz., the manufacture of those encaustic tiles in the production of which he remained at his decease without a rival.

It was during the last century only, that the attention of antiquaries became specially directed to the ancient tiles to which the designation of encaustic has been given, and which were very generally adopted by the architects and builders of the middle ages to form the pavements of churches and other structures throughout our native country and some parts of France, especially Normandy. The earliest which have been found have apparently belonged to the latter part of the twelfth century, but it appears from the excellence of the manufacture, the quality of the remains, and the beauty of the designs, that the culminating point of excellence and popularity was attained during the thirteenth. Examples have been found in Ireland, Scotland, and all parts of England, and notably in the latter country at Westminster, Gloucester, Malmesbury, Salisbury, Romsey, Malvern, Tintern, Winchester, Tewkesbury, and Chertsey; the specimens which belonged to the last named place being the most admirable, in point of manufacture, of any which I have yet had an opportunity of studying. Another beautiful specimen is the pavement in the Chapter House at Westminster, and it is also one of the earliest, its date being coeval with that of the building it decorates.

Much variety of design is to be found in tiles of this description, owing to the fact that their manufacture was apparently carried on by almost every religious house which possessed clay of a proper description for the purpose. The devices generally found upon them consist of armorial bearings, mottoes, monograms, ornaments appropriate to the architecture of the building, sacred symbols, and texts of Scripture or pious maxims. In some cases tiles with incised inscriptions were used instead of stone slabs to mark the site of graves which lay below the floor of a church.

It would be irrelevant to dwell upon the archæological interest of these reliques of the past, but it is essential to note the important part they played in enhancing the general decorative effect of the finest mediæval interiors. A close examination of many of these tiles, and the discovery, at Great Malvern and St. Mary Wilton, near Droitwich, of two ancient kilns, in which tiles in different stages of manufacture were found, enabled those interested in the matter to predicate almost with certainty the ancient process of manufacture, which appears to have been somewhat as follows.

The moist clay having been well beaten together was compressed into the form of thin squares, which were generally of the size of from four to six inches and one inch in thickness. These were probably exposed to the sun until they had acquired the proper degree of plasticity to retain any design impressed upon them by a stamp, so formed as to indent the ornamental pattern upon the face of the tile. The indented pattern was then filled up with a different coloured clay, which was usually pipe or other white clay. After the tiles were put into the furnace, a thin coating of powdered lead ore, mixed with clean sand, was probably dusted over their surfaces, so as to give a vitreous glaze when withdrawn from the kiln, which gave permanence to the work, and added to the richness of the effect. This glaze gave the white clay a slight tinge of yellow, and added fulness of tone to the red colour which usually formed the ground upon which the pattern was relieved.

The revival of these processes was, I believe, first con-

templated by Mr. S. Wright, of the Staffordshire Potteries, about thirty years ago, who took out a patent for it as an original invention. It was some years before any good specimens could be obtained, but he advanced sufficiently to encourage the hope that success might be ultimately attained. This, however, was reserved for Mr. Herbert Minton, who purchased the patent to effect. He set to work with a thorough English determination to succeed, and with untiring energy and perseverance, notwithstanding repeated failures, and many difficulties and obstacles which presented themselves in his successive experiments, at length succeeded in producing tiles very far superior to those of the ancients. From the above hasty description the problem of manufacturing encaustic tiles does not appear, at first sight, to be attended with any great difficulty or complexity; in practice, however, in the present day, the case is very far different. In the first place, clays have to be mixed to burn with certainty to uniform tints throughout their bodies. In the second, each of these bodies requires different tempering so as to correct the irregularities of shrinkage induced by the diversity of materials mixed with the clays to obtain the required colours, so that the filling-in in one-coloured clay shall not pull away and "craze" all over, or detach itself from the incised base into which it is to be fixed by firing. In the third place, the range of colours used by the potters of the middle ages was limited to two—buff and red. Gradually, Mr. Minton added to this range—marone, cream colour, black, grey, and fawn, in through coloured clays; and blue, green, white, crimson, lilac, and purple, in enamels of porcelainous body, floated over portions of the surface of the tile slightly sunk to receive comparatively thin coatings of brilliant colours.

The difference in the shrinkage of the clays, while merely drying, or from simple evaporation, and while they are exposed to the heat of the fire, is an even more difficult problem than that involved in the adjustment of the materials for a compensating balance-wheel to a chronometer, or a pendulum to a clock, since that which does for the drying may not suit the firing, and *vice versâ*. Dependent upon this nice balance of conditions are not only the cohesion of the surface without any gap or fissure, but the flatness of the tile as a whole. This last quality may be also deranged by the kiln not working equally, so that one side of a tile shrinks before the others. The remedy is chiefly derived from an intimate practical acquaintance with the actual shrinkage of the various materials, and not only so, but also of their various combinations. These last are not always, nor are they often, results that can be calculated from the known constants of the separate materials of which the tiles are composed, since those constants are sometimes deranged by chemical action consequent on admixture. Great practice, based upon costly experiment, can alone give the necessary knowledge.

The great danger which the makers of encaustic tiles have to guard against continually is the impending risk of having a whole kiln full of valuable tiles spoiled in the firing, for in order to bring out the colour and obtain the requisite hardness of texture the fire must be carried to the very verge of destructiveness, and by overstepping that limit but a little, actual destruction to the tiles in the kiln ensues. Moreover, until the kiln is opened, no one can certainly tell what its fate may be. The criterion usually adopted is the shrinkage of "trial pieces," which are tried by a guage, and as soon as they will drop into the guage, the kiln has been sufficiently fired. Kilns usually take four days and four nights firing, and after that three or four days cooling.

The following is a rapid summary of the processes actually employed in Mr. Minton's perfected manufacture. The clay is entirely obtained from the immediate neighbourhood of the Stoke works, and as was the case in ancient practice, two different varieties are found without any foreign admixtures to produce when fired satisfactory red and yellow colours. Other tints are obtained by adding to these and other bodies various metallic oxides. In order to adjust these bodies to an equilibrium of shrinkage, both in the kiln when fired and after cooling, other materials, such as Cornwall stone and clay, and silex from Kent, &c., are added, and in their nice adjustment, as the greatest risk is incurred, so is the greatest skill involved.

After the clays have been properly purified, and brought into a liquid or "slip" state, they are passed through fine lawn sieves, especially those which are to form the surface of the tile. They are then boiled in the "slip kilns" to bring them into a plastic state, ready for the moulder. The pattern which is cast in relief in plaster is placed in a metal frame, of a size sufficient to allow for the shrinkage of the tile in the process of its manufacture (for a square of 6 inches the size of the mould being 6⅝ inches square). The surface of the tile is formed of fine clay flattened out, and ¼ inch thick. This being pressed on the plaster pattern, of course receives an exact impression of the design in "entaglio." The requisite thickness of the tile is gained by adding upon this first layer of fine clay, clay of a coarser kind, half an inch thich, covered again by a stratum of the same clay which forms the face, so as to counteract its shrinkage, which would otherwise pull the tile into a curved section. The whole is then put under a press to give it sufficient solidity. This being done the colours required in the pattern are added by pouring the coloured clays in a slip state into the parts of the indentation intended to receive them according to the design. The slips flood the surface of the tile, and thus for a time obliterate the design altogether. In this state they are left three days, until the water has nearly all evaporated, when the surface is carefully scraped and planed until the pattern is again seen, and all unevenness removed; but still there is no great difference of colour discernible in the clays which form the surface of the tile. After this the tile is left in the drying house for a fortnight to three weeks, when it is taken to the oven, and there for 60 hours is submitted to an intense heat, which brings out the colours. The tile is then finished, unless it is required to be glazed, which is done by simply dipping the surface of the tile into the glaze, and then placing it in a glazing oven to be refired.

The requirements of modern art have been met in the production of bright blues, greens, &c., by inlaying with a porcelain body coloured by means of oxides of cobalt and chrome, and a mixture of chrome and zinc. The introduction of the colours involves some not inconsiderable manufacturing difficulties. For instance, there is no red clay known (excepting those of Staffordshire and Broseley) which will satisfactorily bear the amount of fire requisite to bring out some of the last named vitreous colours, and even with them the risk and loss is frequently serious, and the compensating process varies as the qualities of the clay which forms the body to be inlaid. One of the many causes of the costliness of these vitreous colours as applied to tiles, is the great room tiles so coloured occupy in the kiln, the face of each being protected by a plain tile, which has no value for any other purpose.

The contact of certain colours in the same tile is usually incompatible; for instance, green next to buff, as the buff is stained by the green. No tiles ought to be fired face to face, as the colours, to use a printer's term, "set off" even where the faces are not in actual contact. The volatilization of the metallic oxides will produce a clearly defined image of one tile on the face of its opposite; and this vaporization has a tendency to affect the general tone of colour of the tiles confined in the same "sugar" or fire-clay box in which they are burned.

The evil tendency of substances usually considered the most fixed in nature to resolve themselves into "thin air," under the power of intense heat, compels the potter to saturate with glaze the inside of the sugars in which his

glazed goods are fixed, in order to hinder the absorption of the vaporized glaze of his goods by the dry and thirsty substance of the sugars. A glazed tile fired in an unglazed sugar would be robbed of all its lustre. These difficulties have suggested the practice of that slight kind of glazing technically called "smearing," in which the whole quantity of glaze is applied by smearing, not the goods to be glazed, but the inside of the sugar containing them. Heat is applied sufficiently intense to volatilize the glaze, and to prepare the surface of the goods to appropriate it to themselves in its vaporous state. The subdued glaze upon chemists' mortars and upon some encaustic tiles, is obtained by this process.

Towards the expiration of the term for which the patent had been taken out originally by Mr. Wright, Mr. Minton permitted Messrs. St. John, Flight, Bar, and Chamberlain, of the Old Worcester China Works, to manufacture encaustic tiles under a license. They were, however, at first, under the great mistake of supposing that any kind of clay, or at least that the clays around Worcester would do for the purpose. Finding that these would not answer, they were at last compelled to send to the celebrated clay beds of Broseley for their materials, thus increasing the cost of the tiles produced. This Company, abandoning the manufacture, was succeeded by Messrs. Maw and Co., who soon perceived the disadvantages under which their predecessors had laboured; and therefore determined to remove their works to Broseley, and thus to plant themselves in the immediate vicinity of those clays which have no rival in this country, except in the neighbourhood of Messrs. Minton's works in Staffordshire.

Mr. I. H. Maw, to whom I am indebted for much valuable information in respect to the encaustic tile manufacture, informs me that he was first led to the subject whilst upon a visit to the parish of Westleigh, North Devon, at the time when the old tiles of the church were being taken up. He has still by him the first step he made in his attempt at reproduction, in the shape of a mould carved in one of the Westleigh patterns out of a block of slate.

Among the most important pavements of encaustic tiles executed by Mr. Minton may be pointed out those of the Houses of Parliament, of Osborne, of the Hall of Assembly at Washington, in America (a pavement of vast extent and elaboration, entirely designed and worked out by Mr. Green, who has now charge of the Drawing Office); of the St. George's Hall, and Town Hall, at Liverpool (produced under the practical direction of Mr. Eyre, who preceded Mr. Green); and of the cathedrals of Ely, Salisbury, and Gloucester. Far and wide over the land, in churches, chapels, halls, private dwellings, and public institutions of all kinds, these beautiful tiles have been laid down, and have given universal satisfaction. Indeed, the measure of success has been in the exact ratio of the difficulties overcome, difficulties which Mr. Minton declared he would surmount, even "if the manufacture of every single perfect tile cost him a guinea."

Having achieved so great a success in his encaustic tiles, Mr. Minton turned his attention to the fifth branch of ceramic art we purpose dwelling on to-night, the Azulejos, or decorative tiles of an earthenware body, covered with opaque white enamel, and coloured in varying thicknesses of transparent enamel tints of the greatest possible brilliancy.

It is to the Arabs, who, probably, derived the art from the Persians, that we are indebted for the introduction into Europe of these beautiful coloured tiles, of which so many specimens still ornament the walls of the Moorish buildings in Spain. In these the patterns are defined by ridges raised above the surface of the tiles, circumscribing hollows, which are partially filled with a thin layer of enamels of various colours, the whole tile having been previously covered with a white "stanniferous glaze." Some specimens of coloured Spanish tiles, of the same kind but more recent date, are to be seen in the museum of the Hotel Cluny; of these many are ornamented in the renaissance style or with finely drawn heads. These are chiefly blue upon a white ground, while other specimens, like the tiles of the eleventh and twelfth centuries, have simply an incised pattern stamped upon them. By a careful examination of some fragments of azulejos brought to this country by Mr. Owen Jones, and of those which form the well-known pavement of the Mayor's Chapel, at Bristol, Mr. Minton was enabled to ascertain the process by which they had been made, and he had little difficulty in arriving at most satisfactory results. How perfectly he succeeded must be obvious to all who have ever examined the beautiful pavements and dados of the Alhambra Court in the Crystal Palace. Various modifications of azulejos, some perforated and others modelled into foliage, were introduced at the suggestion of the late Welby Pugin, who, in this department of ceramic art, as well as in improving the designs for porcelain slab paintings, printed earthenwares, and encaustic tiles, had been of great assistance to Mr. Minton. Their enthusiastic natures were, indeed, so kindred, that their business relations speedily ripened into fast and enduring friendship. It is to be regretted that, with a few notable exceptions, architects have not adopted this beautiful manufacture as they ought.

Our sixth section comprises the revival of geometrical mosaic as a structural adjunct. This revival may be said to have commenced in 1839 and 1840, with the attempts of Mr. Blashfield to produce satisfactory pavements by the employment of coloured cements, inlaid asphaltes, and Venetian Pisé work; with the clever inventions of Mr. Singer, of Vauxhall, aided by his ingenious assistant, Mr. Pether, and last, but not least, with that brilliant idea of Mr. Prosser's, of solidifying China clay in dry powder, by subjecting it to great pressure in iron moulds from which it could not escape, and thus, at the same time, avoiding the shrinkage due to the evaporation of the moisture previously indispensable to keep the clay in a plastic state, and obtaining, by the forcing together of the moleculæ, a substance of extraordinary density and evenness of texture throughout its body. Quite recently, I may here mention, a process has been invented by Messrs. Maw and Co., who are now actively engaged in the mosaic business, whereby that closeness of texture, and consequent hardness of surface, only to be obtained by aqueous shrinkage, may be given to tesseræ, hitherto dependant for hardness upon the mechanical pressure of materials in a dry or nearly dry state. Of Messrs. Blashfield's, Singer's, and Prosser's abilities, Mr. Minton availed himself largely. Mr. Blashfield carried on an active agency for him in London. From Mr. Singer he took out a licence for a patented system of laying small tiles and tesseræ, and in Mr. Prosser's patent he became largely interested. The object for which Mr. Prosser's presses were first set to work were the manufacture of buttons of different kinds, and for some time a very large trade was driven in this department of industry. Subsequently, however, the ingenious automaton machine, invented by M. Bapterosse, of Paris, by means of which multitudes of buttons are made at every stroke of the die, and at once carried off into a reverberating furnace by means of which they are fired in about ten minutes, superseded Mr. Prosser's original form, and Mr. Minton abandoned the manufacture of buttons. It was, I believe, Mr. Blashfield who suggested to Mr. Minton the applicability of the process to the production of tesseræ, or small cubes, suited for the formation of tesselated pavements, in imitation of those of the ancients. Mr. Minton went into the matter with great spirit, and excellent tesseræ of all colours were speedily made. For their arrangement Mr. Owen Jones suggested many very beautiful geometrical combinations. In the winter of 1844 I went abroad to study my profession, and took with me a commission from Mr.

Blashfield to collect for him any thing I might meet with calculated to assist in utilizing these tesseræ, upon the manufacture of which Mr. Minton was at that time entering. Finding in Italy and Sicily a good deal of material to which, as far as I could ascertain, no one had previously paid much attention, I was induced to make the series of drawings subsequently published in my work on the "Geometrical Mosaics of the Middle Ages." Mr. Blashfield having shown the drawings to Mr. Minton during my absence, on my return, in the spring of 1847, I found the latter anxious to employ me to assist in the extension of his views, both with respect to tesselated work in general and its combination with encaustic tiles. My first interview with Mr. Minton was in reference to the pavement for Osborne, upon which he consulted me professionally, and from the date of that interview until his death I was happy in securing his kindly interest and regard. The drawings I made for him in consequence of that interview are exhibited this evening. It was through Mr. Blashfield and Mr. Minton that I was induced to present myself, for the first time, as a lecturer in this room, on the 3rd of February, 1847. When, in 1849, I had the distinguished honour to be employed by this Society to examine for them and report upon the Parisian Exposition of that year, and upon the system of expositions as conducted in France, I had the good fortune to examine the whole of the ceramic products with Mr. Minton very carefully; again at Birmingham in 1849; in this room, at the Mediæval Art Exhibition; in Hyde-park, in 1851; and at Paris in 1855; I had similar good fortune: and I can certainly say, that, not in the branch of mosaic alone, but in every direction in which it is possible for ceramic products to be applied to art purposes, Mr. Minton's zeal and interest were, if possible, more keen and sanguine in 1855, when all that he could have hoped for ten years previously had been crowned with success, than they were when he stood upon the threshold of his first and happiest introduction of novelty and improvement. Having dwelt at length upon the various processes connected with mosaic work, in a paper printed in the Society's Transactions, new series, Vol. I., I need not detain you in reference to them; neither is it necessary for me to dwell upon the excellence, beauty, and durability of nineteenth century mosaic, so long as the pavement of your hall, the tesseræ for which were presented by Mr. Minton, remains in its present perfect and elegant condition. The central feature of its design is based upon one of the drawings I made for Mr. Blashfield, from the church of San Bartolomeo nell' isola del Tevere, Rome. The design, and the laying down of this pavement, which is a first-rate piece of work, were presented by Mr. Blashfield. Among all the numerous pieces of excellent tesselation carried out by Mr. Minton, I think I may point to the pavement of the Atrium and Tablinum of the Pompeian House, in the Crystal Palace, executed from my designs, as at once the best, the best known, and the one of which he was the most proud.

Time warns me to proceed, without delay, to the remaining very important sections of our subject. These, respectively—Luca della Robbia ware, Majolica, and Palissy ware—though each possessing distinct characteristics in point of art, and claiming attention for excellencies, either of design or fabrication, special to each—have yet so much in common, that it will be best, and probably clearest, to advert to them as a group. Theoretically speaking, the basis of manufacture is common to all three—viz., a calcareous clay body, covered with an opaque white enamel, composed of sand, lead, and tin—colours being added by enamelled glazes.

At this distance of time it is difficult to determine whether the manufacture of Majolica ware was derived by the Italians from Sicily, Greece, or Majorca, or whether they owe the fabric to the improvements introduced by Luca della Robbia early in the fifteenth century, previous to which the pottery of Umbria and Tuscany was a common earthenware, covered with an opaque veneer, made from a white clay found in the province of Sienna, and known as "terra di San Giovanni." When covered with this revêtement, the vessel was heated till the outer coat was reduced to a state of "biscuit;" it was then covered with a glaze, in which any colour desired was mingled, or the white coating was ornamented by painting in enamel colours, which were then covered with a transparent glaze. A final baking vitrefied the colours and glaze, thereby rendering them permanent. Wares so produced are known to connoisseurs as "Mezzo-Majolica." Amongst many other improvements, Luca del Robbia substituted, for the original coating of white clay, a thin opaque glaze composed of sand and tin, with a small quantity of antimony and other metallic substances. Through his rare talent as a modeller, his ware attained an extraordinary popularity, and was used extensively as a beautiful architectural adjunct throughout Tuscany. Some idea of the scale upon which this material was employed may be obtained by an inspection of the great frieze from the Ospedale dei Poveri, at Pistoia, a reproduction of which surmounts the Renaissance and Elizabethan Courts at the Crystal Palace. Our modern architects have singularly neglected to avail themselves of Mr. Minton's beautiful revival, and I believe that my use of it at the Paddington Station, and in one or two other places is almost unexampled. Luca della Robbia's process appears to have been known to the Arabs in the thirteenth century, and is believed to have been in their possession as early as the ninth century.

An extensive trade in vessels of Majolica ware was carried on in Italy in the sixteenth century, principally in the Duchy of Urbino, whose duke, Guid'Ubaldo della Rovere, in 1509, granted a patent to Giacomo Lanfranco, of Pesaro, for the application of gold to the ornamentation of earthenware. Asciano is considered by Passeri to have been the first town in Italy possessed of an established manufactory of Majolica ware, but at the date referred to a very large quantity was produced in the towns of Perugia, Rimini, Spello, Bologna, Sienna, Forli, Civita-Castellana, Faenza, Gubbio, &c., in the last mentioned of which some years later a series of improvements were introduced into the manufacture of this species of pottery by Maestro Georgio Andreoli, who introduced a splendid ruby colour into his draperies. When completed, the painting was often covered with a glaze, which in firing, gave a peculiar brilliant metallic and prismatic lustre to the surface of the object fired. Vincenzo Andreoli, the son of Maestro Georgio, carried on and still further improved his father's manufactures.

Majolica ware attained great perfection under the Fontanas and Baptista Franco, declining in excellence under the too facile hands of the Zucchari.

During its best days—between the years 1520 and 1560—the engravings of Marc'Antonio, Marco di Ravenna, and others, from the designs of Raffaelle and Giulio Romano, became diffused throughout the country, and were eagerly seized upon and applied to the decoration of the ware which at that time was largely used by the Italian nobles for their tables as well as for ornamental purposes. Timoteo della Vite, one of Raffaelle's favourite pupils, is said to have greatly improved the forms and ornaments of these vessels. Some specimens of Majolica ware, which had formed part of the collection of the Duke of Buckingham, having come into Mr. Minton's possession, his attention was directed by them to a revival of the art, with what success is shown by the various beautiful productions which adorn the room this evening.

For much of the success of this revival, Mr. Minton was indebted to the consummate knowledge of enamel colours and glazes, as well as to the taste and judgment possessed by M. Léon Arnoux. His brilliant success in Palissy wares, in highly decorated earthenware and encaustic tiles, unquestionably won for the firm the

great honours it received at the Exhibition in Paris of 1855. The demand for these objects is increasing beyond the utmost capabilities of the vast establishment at Stoke to supply. To recur to the story of Bernard de Palissy, would be only to repeat some thrice-told tale, already worn threadbare by authors and artists. The peculiar character and design of his wares must be known to all, and it is not too much to say that Mr. Minton's productions can scarcely be distinguished from the best of those over which the genius and influence of François Briot is most manifest. Did time permit, I might dwell further on the interesting experiments tried by Mr. Minton on glazed, enamelled, and hollow bricks, and on the extension of terra cottas, coloured and uncoloured, but enough has already been advanced to justify my having brought the subject of his industrial career under your notice this evening. I have been induced to do so, not from any invitation I have received, nor from any special capabilities I possess for the task of chronicler, but solely because I honoured and esteemed Mr. Minton as a manufacturer, and loved him as a friend. He indeed possessed the great gift of winning personal regard from all classes. From your Royal President, who admitted him to the earliest councils held with respect to the Great Exhibition, which Mr. Minton was one of the earliest to accept in its international aspect, and the ducal family of Sutherland, to the humblest workman in his employ, Herbert Minton won an amount of esteem and friendship, which almost merged into the warmer condition of steadily sustained affection. Among the members of this Society, of which he was long a Vice-President, he might count, I believe, friends by the hundred. With the chief representatives of the retail trade he maintained the best understanding, and with the late Mr. Phillips, whose sons exhibit to-night so fine a series of his products, for nearly fifty years he kept up an interchange of kind feelings and good offices.

In ascribing so large a measure of the progress which our ceramic manufactures have made within the last twenty years to Mr. Minton's activity, I should, however, desire to carefully guard myself against being supposed to ignore or underrate the contemporaneous labours of his partners and others. It was, indeed, mainly owing to the generous competition, in excellence at least, as much as in price, which subsisted between his firm and the establishment presided over by Mr. Alderman Copeland, that Mr. Minton's energy and resources were never allowed to flag. If one firm lighted upon a first-rate modeller one month, an equally clever painter was nearly sure to be discovered by the other. If Minton's glaze one season was more brilliant and less greasy-looking than Copeland's, next year the chances were that the latter's white paste was more perfectly white than the former, or that some other corresponding symptom of advance characterised the year's production. Any improvement which for a while seemed tending to concentrate the golden harvest upon one alone, very speedily ceased to be a monopoly, and from a point of equal excellence the struggle was renewed—the popular voice, and yet more eagerly, the popular demand, being the great prize of the contest.

This competition, was, however, for a long time, limited to the branches of fine earthenware and porcelain, the ordinary and extraordinary table services of the middle and upper classes, and the more purely ornamental specimens, such as vases and groups. The introduction of Parian statuary, or Carrara ware, as it was somewhat indifferently termed, added a new stimulant to the exertions of both parties; and, even to the present day, it is hard to determine whose productions are most excellent, when regarded from either a manufacturing or artistic point of view. Nor was it alone over the studies made by the great house of Copeland, and the activity of Mr. Battam, that Mr. Minton had to be ever watchful. His friends and neighbours in the potteries, Messrs. Ridgway, Mayer, Dimmock, Allcock, Meigh, and Boote, and Messrs. Rose, of Coalbrookdale, trod at times so close upon his footsteps in the excellent, rapid, and cheap production of porcelain and earthenware for the general market, that for Mr. Minton to have stood still for a moment would have been to lose his lead in the trade. With the Messrs. Wedgwood, who retained so many of the designs, models, and traditions which had originally established the reputation of the English Etruria, Mr. Minton, as I venture to think, wisely abstained from entering into any serious direct competition. After the death of Payne Knight, Towneley, Sir William Hamilton, Hope, Soane, Gandy Dering, Flaxman, Tassie, and others, the Dilettanti Society's energy flagged; and public taste was diverted from the pure and classical fountains of inspiration which had nourished the productions of the class of design, founded upon the best models of the antique, and which pervaded all the finest works of the great Josiah Wedgwood.

No one knew better than Mr. Minton the sacrifices any manufacturer must be prepared to make, who would enter upon the Herculean task of attempting to stem the current of fashion, however obviously contrary to right, wisdom, and good taste, it might be running. No one was more fully awake to the almost impossibility of re-creating an appetite, already and recently satiated. To stimulate the jaded imagination, no less than the jaded body, after a fitting interval of repose, food of a character as widely different as possible from that last greedily absorbed, can alone be successfully administered. Upon this principle, the wise manufacturer will prudently direct his efforts to the production of novelties, as far as possible, only in the ratio of the demand for them;—concentrating his attention while that demand is sluggish upon the improvement of current production; and dashing out into judicious speculation when he finds the public tired of its usual "pabulum," and panting for some striking variation of diet, or novelty of sensation.

Thus it was, as I believe, that Mr. Minton refrained from entering into any direct competition with the illustrious founder of the old glories of the Staffordshire potteries, leaving to the descendants of Mr. Wedgwood an undisturbed possession of the market in the class of goods ordinarily known as Wedgwood ware, now once more greedily sought for, and, as a consequence, extensively produced. In terra cotta works, Mr. Blashfield, in encaustic tiles, Messrs. Maw, in mosaics, Mr. Singer, and in the finest china, with perforated coatings and ornamented with lace dipped in slip, and hand-wrought flowers, after the manner of Dresden, Messrs Chamberlain, of Worcester (whose firm is now so well represented by Messrs. Kerr and Binns), ran Mr. Minton hard, and, to use a common expression, kept him up to his work. The greater, however, the merit of his rivals, the greater must be the credit conceded to Mr. Minton for retaining the honourable position he constantly maintained, in comparison with them, in all departments of ceramic production.

It is a hopeful and gratifying circumstance that the two men, Josiah Wedgwood and Herbert Minton, whose exertions for the improvement of this branch of manufacture were most strenuous, whose sacrifices to combine the highest degree of artistic beauty with the simplest and most certain processes of fabrication, were unremitting, and whose confidence in the golden rule of industry—that the best manufacture must, in the long run, command the market—remained unshaken by temporary failure or disappointment, should have ultimately attained, not only celebrity, but fortune as well. Each of these two distinguished men felt, to the very end of their laborious lives, that all they had done was but the germ of what might yet be done for the development of the branch of production on the perfecting of which all their efforts had been concentrated. In the very important evidence given by Mr. Wedgwood, in the year 1785, before a Committee of the Privy Council, and at the bars

of both Houses of Parliament, he stated, that "important as were the advances which at that time had been made in the art, he was still of opinion that they could be considered but as the beginning of improvements; that these were still but in their infancy, and but of little moment when compared with those to which the art was capable of attaining, through the continued industry and growing intelligence of the manufacturers, in combination with, and fostered by, the natural facilities and political advantages enjoyed by the country." Mr. Minton, though ready and fluent in general conversation, was of too nervous a temperament to shine as a public speaker. On two notable occasions, however, he was forced to make some observations in public in relation to his position and experience as a manufacturer, and on those occasions he certainly spoke from his heart. When he received a beautiful silver and ebony casket, together with formal congratulations from his staff of assistants and workpeople, on obtaining the only Council medal awarded to an English manufacturer of ceramic wares by the jury of Class XXV. of the Great Exhibition of 1851, he replied as if in anticipation of the efforts he would be compelled to make in 1855:—"We are convinced that, without mutual co-operation and friendly feeling, all individual efforts are comparatively fruitless. Let not, then, past success satisfy us for the future, but rather let it act as a stimulus not only to maintain the high position we now occupy, but to go on improving, with the view of securing still higher distinctions."

Again, when the same staff and workpeople met him at the close of the last named year, to offer renewed congratulations upon his success as a competitor in the Universal Exhibition at Paris, and on his receipt of that mark of personal distinction, the Cross of the Legion of Honour, which he, in common with several others who obtained the same reward for services rendered in other departments of science, art, and industry, accepted with feelings of just pride, and ever regarded with sentiments of satisfaction,—Mr. Minton, in reply to an allusion to his long and prosperous career as a manufacturer, said, "Forty-nine years have now elapsed since I first entered the manufactory in which you and I are now engaged; and it is with much pleasure and satisfaction that I can look back upon so long a period, spent amongst my workpeople, with almost uninterrupted happiness." In conclusion, he pointed out the advantages of several institutions, in the establishment of which he had long taken a deep interest, and to each of which he had been a liberal contributor, as follows:—"I must congratulate you on your now possessing, in your own town, a School of Design, a School of Science, and an Athenæum; and I most earnestly entreat you to avail yourselves of the advantages thus afforded you; for, I am fully persuaded, that the information and practical knowledge which you will attain by making the best use of them, will enable us to produce much finer works of art than we have hitherto done."

Again, on the all important question of the right direction and scope of competition in manufacture, every sentiment put forth by Mr. Wedgwood in the admirable remarks with which he accompanied his catalogue of products, published in the year 1777, found its echo not in the language only, but in the whole life and works of Herbert Minton. In reading the following noble passages, I can almost fancy them to be the condensation by some able writer of the disjointed apothegms, which from many long and interesting conversations I should have gathered up as the manufacturing creed of the friend we have lost, and whose career we are now commemorating.

Mr. Wedgwood by his pen, and Mr. Minton by his life, may, therefore, be regarded as urging what it would be well for the honour and prosperity of our native country, if manufacturers were never to forget, that "A competition for cheapness, and not for excellence of workmanship, is the most frequent and certain cause of the rapid decay and entire destruction of arts and manufactures. The desire of selling much in a little time, without respect to the taste or quality of the goods, leads manufacturers and merchants to ruin the reputation of the articles which they make and deal in; and whilst those who buy, for the sake of a fallacious saving, prefer mediocrity to excellence, it will be impossible for them either to improve or keep up the quality of their works.

"All works of art must bear a price in proportion to the skill, the taste, the time, the expense, and the risk attending the invention and execution of them. Those pieces that for these reasons bear the highest price, and which those who are not accustomed to consider the real difficulty and expense of making fine things are apt to call dear, are, when justly estimated, the cheapest articles that can be purchased, and such are generally attended with much less profit to the artist than those that everybody calls cheap.

"Beautiful forms and compositions are not to be made by chance; and they never were made, nor can be made in any kind at a small expense, but the proprietors of this manufactory have the satisfaction of knowing, by a careful comparison, that the prices of many of their ornaments are much lower, and all of them as low as those of any other ornamental works in Europe of equal quality and risk, notwithstanding the high price of labour in England; and they are determined rather to give up the making of any article, than to degrade it."

In addition to the common zeal for progress in art and manufacture which animated these two Staffordshire worthies, there was yet a higher and a holier ground upon which they took a noble stand. In quick and expansive sympathy with the necessities, moral, physical, and intellectual, of their fellow-men, Wedgwood and Minton gave freely, with willing hearts and with unstinted hands. Our business this evening has been with the chronicles of ceramic manufactures, and not with the pious zeal and charities (however noble they may have been) of the man who has done more than any other, during the present century, to perfect the business in which he spent his life. Had his faith as a Christian, and his genial excellence as a man, been our theme tonight, instead of his abilities as an industrial agent, instead of dwelling on the faculties and energies which made him known and esteemed amongst men, a far greater prominence than it has now been thought right to award would have been given to those qualities which will stand him most in stead, now that this our brother has ceased from his labours amongst us.

DISCUSSION.

Mr. J. G. CRACE would venture to address a few words on this, as he considered, most important question. He felt so much regard for the late Mr. Herbert Minton, and appreciated so highly his endeavours to advance the manufacture in which he was engaged, that, although he felt embarrassed in addressing them, he was, nevertheless, particularly glad to have an opportunity to express how highly he valued the late Mr. Minton's moral qualities, and his high talents as a manufacturer. Many in that room had a vivid recollection of his genial, kind, and pleasant manners, and how, in matters of business, it was a pleasure to meet him at all times. They would also remember the terms in which, on many occasions, he had expressed his sentiments in relation to the improvement and happiness of the working classes, and how anxious he was at all times to advance their interests; how he built churches and schools for their benefit, and did all that he could in every way to further the happiness of all who were brought into connexion with him. As a manufacturer, the late Mr. Minton must certainly be regarded as having occupied a proud position, having largely contributed to advance the honour of this country in relation to this branch of manufacture on two celebrated and memorable occasions;

indeed, he did not know in what position England would have stood as regarded this branch of art in 1851 and 1855, had it not been for him. He (Mr. Crace) could not call to mind any former occasion in which British art was so completely vindicated as on that when the gold medal was awarded to Mr. Minton at the Paris Exhibition. His dessert service, exhibited in 1851, was rightly esteemed by the Queen as a fitting present to the Emperor of Austria, and at the Paris Exhibition in 1855, so highly were the works of Mr. Minton appreciated that there it was scarcely possible for an article to remain an hour without its being purchased, so anxious were people to secure them. In fact he thought the appreciation of those works was higher in Paris than in this country. Mr. Minton was always in advance of his time. He appreciated and enjoyed all that was beautiful, and felt a delight in realizing the most exquisite designs that were brought under his attention. As an illustration of this remark, Mr. Crace mentioned that on one occasion being shown a plate of exquisite design and manufacture, Mr. Minton was challenged to produce its equal. Having obtained possession of one of those plates, he took it away with him and succeeded in producing an article fully equal in all respects to that upon which the exercise of his skill had been challenged. There was that sort of happy, industrious, energetic character about the late Mr. Minton, which was rarely to be met with. All who knew him must deeply deplore his loss, and in this society he would be particularly missed. As regarded his works they spoke for themselves. Many present would remember the large fountain which Mr. Minton exhibited at Paris, and the elaborate manner in which it was ornamented; and in the ordinary mercantile productions, such as tea and breakfast services, such was the advance made by Mr. Minton, that they excelled that class of French manufacture, taking price into the comparison as well as quality; and the same might fairly be said of his enamelled earthenware articles. In fact, taking his productions altogether we had reason as Englishmen to be proud of our departed friend. He had not only earned a reputation which would probably live as long as this country remained; but he had greatly aided in gaining for England the respectable position she had now attained in the arts.

Mr. DANIELL felt considerable diffidence in obtruding himself upon the attention of the meeting, but he wished to testify his sympathy with the object for which they had been called together. The late Mr. Herbert Minton he had had the pleasure and the honour to claim as a friend from boyhood. He had enjoyed his society as much as any other man of his age connected with ceramic manufactures, and on that memorable occasion in 1855, when Mr. Minton representing himself, and he (Mr. Daniell) representing an equally important firm, were in Paris, they lived together in the same house and were the best of friends. To speak of the late Mr. Herbert Minton as a man, would be only to do that which had often been done before. His goodness was known to all, and his liberality was experienced by every one who needed it. When they came to speak of him as a public man and as a manufacturer, it needed not his feeble voice to say one word in his praise. His productions spoke for themselves; but though a great man had fallen from amongst them, yet greatness itself was not dead. There were others upon whom it was to be hoped the mantle of the departed had fallen, and he trusted his audience would give him credit for sincerity when he said that, though this might be regarded as the funeral éloge on Mr. Herbert Minton, he could not look upon it as the funeral oration of ceramic manufacture. The advantages which the late Mr. Minton possessed, were such as few ordinary men could obtain. Beloved by all—generous himself to all—anything he asked for was at his command. He (Mr. Daniell) recollected some years ago asking to be allowed to copy the design of a cup and saucer in a celebrated collection, but he was refused on the ground that the value of these articles would be thereby depreciated. The late Mr. Minton, however, had been differently treated, for there was scarcely a subject in any collection which he was not allowed to copy. With reference to Mr. Minton's predecessors in this branch of art, he might remind the society of one whose name was upon their records as the recipient of the society's gold medal for china and porcelain manufactures long before Mr. Herbert Minton's time. He referred to John Rose, of Coalport, who made more china in his day than all those who were mentioned in the paper. His successor still lived in the person of his nephew. It must also be remembered that there still lived in the late Mr. Minton's firm the man to whom that gentleman was always ready to acknowledge his great obligations, Mr. Michael Hollins, but for whose genius the splendid productions then before them would probably never have reached the perfection they had done.

Mr. HYDE CLARKE congratulated the Society upon the able and eloquent paper which had engaged their attention that evening. He had no contribution to offer on this subject beyond bearing his humble testimony to the readiness of the late Mr. Herbert Minton to furnish specimens or designs with a view to the spread of this branch of art manufacture. As a member of this Society he wished to express his obligations to Mr. Digby Wyatt for the paper he had brought before them, which he agreed with the last speaker in not regarding as the funeral oration of ceramic manufacture, but as a well merited tribute to one who had rendered eminent service to his country. It was only in that character that he understood the address of Mr. Digby Wyatt, and as the orator of the Society on this occasion, he had paid a well merited tribute to the memory of Mr. Herbert Minton. He also congratulated the meeting on being presided over by a gentleman who, by his personal patronage and influence, had for many years laboured so successfully to promote the manufacturing arts of this country.

Mr. GEORGE WALLIS said, as one who had the privilege to know the late Mr. Minton, and who admired his energy and earnestness, he could not but thank his friend, Mr. Wyatt, personally, for his noble paper. For some years past he (Mr. Wallis) had been in the habit of meeting Mr. Minton from time to time, and he saw much of him in the United States of America in 1853, and at Paris in 1855, and could bear full testimony to the truth of the eulogy which had been pronounced. He thought some mistake had arisen as to the true purpose of the paper, which was not on the general progress of ceramic art, but on Mr. Herbert Minton's special share in that progress. Other eminent firms had done much, each in its own special department. Copeland's, under the able direction of Mr. Thomas Battam, Messrs. Rose, of Coalport, in their way, whilst the old house of Chamberlain's, of Worcester, now so ably represented by Kerr and Binns, had a position of its own, but the work of none of these was negatived, because Mr. Minton's labours were more distinctly traced out. Mr. Minton's reputation was of too pyramidal a character to need any extraneous aid by detraction from, or neglect of, others. He (Mr. Wallis) could undertake to speak from personal observation of the work Mr. Minton had done in the Staffordshire Potteries at least. It was in 1837, 21 years since, that he first visited that district, and though young in years then, and still younger in his knowledge of art, yet he could not conceal from the manufacturers the disgust and wonder with which he regarded the amount of ugliness they contrived to get into and upon a beautiful material. Nine years after he visited the potteries again. In the interval a great change had taken place, thanks to Mr. Minton and to Mr. Thomas Battam, acting for Copeland's house. Nine years later, in 1855, they all knew what resulted, and he had no hesitation in saying that but for Mr. Minton, the beautiful display of Majolica ware, at least, then before them would have had no ex-

istence. He thought it was a most fitting thing for the Society of Arts to have afforded an opportunity for this eulogium on such a man after his death. We had too little of this in England. The only eulogy usually heard was "Well, he is gone, poor fellow! How much money has he left behind him?" as if he could take any of it with him. Something like this had been already said about the subject of the memoir of that evening. It was stated that Mr. Minton had died worth "so much" money, but that the greater portion was invested in moulds and models; as if they were not good property in good hands. He (Mr. Wallis) trusted, however, that the time would never come when some future ultra-utilitarian partner of this now eminent firm might serve them as Wedgwood's models and moulds were served—cast them off the premises at Stoke as old plaster.

Mr. Blashfield, having been for many years intimately associated with the late Mr. Herbert Minton in the revival of the ceramic art, would say a few words on the present occasion. In 1839, attempts had been made to introduce improvements in the pavement and decorations of public buildings, and Mr. Minton took out a patent for encaustic tiles, in the production of which his success was so well known. About the same period he (Mr. Blashfield) had the honour of laying down, in the saloon of the chairman's beautiful residence, a Venetian pavement, and he was indebted to that gentleman for some very valuable suggestions on that subject. He (Mr. Blashfield) had had much to do with the revival of coloured pavements; and he at first tried to cut the tiles for that purpose, much in the same way as bakers cut out their biscuits, but all his attempts were unsuccessful. Subsequently his attention had been drawn to some very beautiful buttons, which, he was then informed, were made of clay pressed between steel dies, without any moisture, according to the method invented by Mr. Prosser. It struck him that the same process would be applicable to the making of tiles, and he brought the subject under the notice of Mr. Minton and Mr. Hollins, and learned from them what had been done in the matter. He agreed with Mr. Daniell that the proper amount of credit had hardly been given to Mr. Hollins for the share he had contributed in the advancement of this art. In his communications with that gentleman he was informed that instead of the clay being used dry in Mr. Prosser's process, the moisture was forced out from between the dies. He believed that it was to Mr. Hollins's scientific knowledge, combined with his great industry, they were mainly indebted for the improvements that had been effected in the art of making mosaic and coloured pavements, which emanated from the attempts that were then made to make good encaustic tiles. The public were not aware how much had been done by Mr. Hollins towards perfecting those beautiful specimens which they saw exhibited that evening. Mr. Minton, urged on in some degree by the zeal and energy of Mr. Pugin, had determined to improve the manufacture of encaustic tiles, and he succeeded in bringing the coloured tile to such perfection as to call forth expressions of enthusiastic delight from Mr. Pugin, who exclaimed to Mr. Minton, "You shall have a *brass* for that." Mr. Minton was so determined to revive the manufacture of the ancient tiles and tesseræ that, although dissuaded by Mr. Prosser from making the attempt, he persevered; indeed, had it not been for his determination, the beautiful machine of Mr. Prosser would have been applied solely to the manufacture of buttons. The first piece of this mosaic pavement was laid down by him (Mr. Blashfield) in the London Coffee-house, on Ludgate-hill, in 1841, and afterwards it was applied at the London Bridge Hotel, and in some of the houses of the higher classes. In the following year, the machine of Mr. Prosser was worked in the Society's room, and some of the pavement made by it was put together according to some drawings made by Mr. Owen Jones. In 1843, the then largest specimens of mosaic pavement were exhibited at the soirée of the Marquis of Northampton, and the Prince Consort, being much pleased with them, requested to be supplied with a particular account of the process employed; a report upon the subject was drawn up by Mr. Prosser, and transmitted to Buckingham Palace. The introduction of that material for paving, and the attention it had attracted in high quarters, led to a demand for it, which could not be met, as Mr. Prosser was not at that time able to supply a sufficient number of machines. In 1845-6 the same description of pavement was laid down in York Minster; indeed, all must acknowledge that Mr. Minton had done very much more for the revival of the mosaic pavement than anyone else.

Mr. B. Waterhouse Hawkins did not rise for the purpose of adding anything to the eulogium that had been passed upon the late Mr. Minton, but he wished to congratulate the Society upon the very graceful manner in which that most legitimate function had been discharged by Mr. Digby Wyatt on the present occasion. To know the late Mr. Herbert Minton was to love him. His works were before them, and it was impossible for any words to add to the appreciation of their beauty, or of the indomitable energy which led to their production. If Mr. Digby Wyatt had omitted anything it might be that he had not had time to speak of that great faith and confidence which Mr. Minton so pre-eminently possessed in works in which he detected the true spirit of art, which art he fostered and carried to a point which had not only raised his own reputation, but that of the country in which he lived.

Professor Tennant had had the privilege of a thirty-five years' acquaintance with the late Mr. Herbert Minton. As an illustration of the perfection to which Mr. Minton carried his productions, he might mention that having been struck with the beauty of some designs he saw at Frankfort, he secured them, and on placing them before Mr. Minton, he found that they were his own work—the earliest specimens of them having been sent to Frankfort, where he (Professor Tennant) was first attracted by them. He joined his testimony to that which had been already given as to Mr. Minton's readiness to impart the fullest information with regard to his manufactures to all who were desirous of obtaining it.

The Chairman said he believed the hour had arrived when it would be acceptable to the meeting that this discussion should be closed. He certainly thought that they had been very fortunate in hearing the paper read on this occasion, but he likewise thought it fortunate for the memory of the late Mr. Minton that the subject had fallen into the hands of the gentleman who had addressed them that evening. It was undoubtedly the case in England that a man who, in works of this description, deserved well of his country, and conduced to its prosperity, could only look to some appreciation of this kind at the hands of his fellow-countrymen. He would not receive public rewards—he might not look for public distinction. Those things were reserved for feats of arms and success in warfare, for social position and high distinction in the political world. They were not bestowed upon men who advanced arts, who promoted science, and who deserved well of their country, in this perhaps more humble, but not less useful walk. Under these circumstances it was fortunate when a gentleman so well able to do justice to the subject as Mr. Digby Wyatt, took it up. They might say, in the words of Horace:—

> "Vixere fortes ante Agamemnona
> Multi; sed ommes illacrymabiles
> Urgentur ignotique longa
> Nocte, carent quia vate sacro."

They had the *Agamemnon*, and also the poet in this case, and they would best show their gratitude by returning to Mr. Digby Wyatt their sincere and heartfelt thanks

for the very admirable manner in which he had treated this subject.

The vote of thanks having been passed,

Mr. Digby Wyatt acknowledged the kind manner in which the thanks of the meeting had been conveyed to him, and explained the circumstances which had led to his having been asked to read this paper. The task was to him a labour of love, and to enable him to accomplish it successfully, he had been furnished with much useful information by the surviving partners in Mr. Minton's firm. With respect to the mention o other manufacturers, in giving to the late Mr. Minton the prominent place he had afforded him, he (Mr. Wyatt) had only followed the awards of the juries of the Exhibitions of 1851 and 1855, and he would remind the members that the object of his paper was not to trace the progress of ceramic manufacture, but to point out the influence which had been exercised upon it by the late Mr. Minton, one of his oldest and dearest friends.

The paper was illustrated by numerous designs for pavements, and specimens of porcelain, Majolica, Parian, and tiles of various kinds, manufactured by Messrs. Minton and Co., and kindly contributed by that firm, as well as by Messrs. W. P. and G. Phillips (Chamberlain and Co.), and the Department of Science and Art. To all these contributors the thanks of the Society are specially due.

The Secretary announced that this was the last Ordinary Meeting of the Session, and that the Annual General Meeting of the Society would, in accordance with the bye-laws, be held on Wednesday, the 30th of June, at 4 p.m.

Home Correspondence.

MR. HYDE CLARKE'S PAPER ON INDIA.

Sir,—Mr. Hyde Clarke, in his paper "On the English Settlements of the Hill Regions of India," read to the Society of Arts last evening, referred to myself and some other persons to make some observations to the meeting, but these we were precluded from offering before the time for closing the discussion had arrived.

An allusion was made to the paper "On the Revenue and Taxation of India," which I had read to the Statistical Society on the previous evening, and to the section of it bearing upon the question of land-tax redemption. Upon this I should have wished to explain to the Society of Arts that, as I do not agree in considering the principles of the modern and recent British legislation of Indian land revenue as either impolitic, oppressive, or unjust, I had come to the conclusion (expressed in full detail in the paper referred to) that, upon the most mature consideration, it appeared to me that the extension of too wide a generalisation of a redemption of the land-tax would be wrong, but that, if the field of its operation were distinctly restricted to Bengal alone, or rather to those portions of the Bengal Presidency where the permanent settlement is an existing institution, and cannot be reversed without such a breach of faith as we refuse, as Englishmen, even to entertain, there would in such case be no valid objection to a land-tax redemption being effectually carried out in that part of the country.

I was glad to hear, from the observations made by Mr. Theobald, that he was distinctly under the impression, arrived at from local and personal knowledge of Bengal, that the native or English purchaser of land found no difficulty from the incidence of the land-tax. This is a further reason in support of the entire practicability and utility of a measure of land-tax redemption, upon the British model, being extended to Bengal.

I am indisposed to agree in the advisability of any scheme which, at the present time, would radically alter the existing relations between the British Government and the rental of land in India. A permanent settlement is virtually essential in any plan of land-tax redemption; and to extend such a settlement further than was accomplished by the Cornwallis legislation of 1793, would be an injudicious renunciation of all power on the part of the State, as chief landlord, to derive advantage from the growing wealth of the country. The British Government has in India largely bettered the condition of the payers of land-tax, not only in the liberal reductions of assessment, but also in the exemption of improvements from the immediate incidence of the impost. And it is not called upon to make further sacrifices without full compensation in the shape of a property and income tax—a tax which is directly consistent with the principles and practice of the ancient Hindoo and Mahomedan laws, but which has recntly been entirely abrogated in British India.

I also wished to have observed that in the figures of comparative taxation in India and in Great Britain (which Mr. Hyde Clarke referred to as having been submitted by me to the Statistical Society), viz., one shilling per head of the Indian population against fifty shillings per head of the British population, I did not attempt any analysis of the extremely complicated question whether, on the average, this comparatively low rate of taxation is, or is not, easier borne in India than in England? The statistical information regarding the different countries of India and the social and physical condition of its people and soil, is not sufficiently complete to warrant a very decided induction in answer to such a question.

My object in referring to this comparison was to present, for the consideration of the Statistical Society, a correction (on grounds which I fully explained) of the Parliamentary statistics of the incidence or pressure of taxation, which were recently published, and represented the ratio of proportionate taxation per head, in parts of India, by figures which, compared with those of the United Kingdom, would be as about nine or ten to one.

Without entering upon the general question, I must, however, request permission to observe that I do not agree with Mr. Hyde Clarke in the proposition that because the common labourer earns (as he states) only two shillings, or one rupee, a month, it necessarily followed that the taxation upon him is severely felt. There are mitigating circumstances of which he has the advantage, viz., the low price of the necessaries of life, the absence of any oppressive fiscal exaction under British rule, and the bounty of the Almighty in giving him the great benefit of independence in respect of lodging, clothing, and fuel, the provision of all of which is so daily and pressing a care upon the European.

I am disposed also to question if two shillings per month is the normal rate of remuneration for unskilled labour in India. In the returns made to the House of Lords in 1853, it was shown that the hire of Coolies and common labourers in many localities was three rupees, or six shillings per month, without provisions, or one rupee, say two shillings per month, with daily allowance of food, and with clothing when required.

The rate of labour-hire does not include the whole question. What is most wanting in India is the example of active industry in the promotion of works of public and private utility, and the continuous employment of labour in a manner beneficial to its people and to ourselves. Any preservation of the dead level of the existing state of things is sincerely to be deprecated. It admits of statistical proof that the exhaustion of resources in unproductive ways has for ages upon ages been the bane of India. And it is indubitably within the

power and the means of British administration to show that this can be reversed; and that a country which, with all the material of wealth, is, generally speaking eminently poor, can be made rich in every sense of the word.

The wonderfully slow general advance, either in prices or in rates of labour, which has occurred in India during the last three centuries, affords some ground for anticipating that any rapid or large advance in these important respects throughout the length and breadth of India is not to be expected. The demand for labour falls on so immense a surface (837,000 square miles), and on so vast a population (132,000,000 of souls), that it is easily and temporarily affected in particular localities without modifying the terms of the general market price.

With due deference to Mr. Hyde Clarke's judgment in this particular, I am hardly inclined to think that the increase in wages is in all respects so desirable to look forward to. If wages are too elevated, the cultivation of cotton and other raw products, to be exported in competition with America and other countries, would soon break down. It appears to me that it would be more desirable to look forward, in the first instance, in India, to a further lowering of the price of food, and of all the necessaries and luxuries of life which a native population is suited to enjoy, and, at the same time, to carrying on the construction and improvement of the great channels and means of land and water transit, so as to mobilize labour and food, to bring out the capabilities of the people and country, and to prevent (as far as is consistent with human foresight) those famines which have hitherto decimated the people of India in almost periodical cycles of time.

In conclusion, I beg to express the extreme gratification I had in listening to the able, lucid, and most interesting arguments contained in Mr. Hyde Clarke's important and practical paper, and which, I am sure, will do credit to the transactions of the Society of Arts. I am, &c.,

FREDERICK HENDRIKS.

Kildare terrace, W., 20th May, 1858.

Proceedings of Institutions.

GREAT WESTERN RAILWAY LITERARY SOCIETY (LONDON).—The annual meeting of the members was held in the Reading-room, Paddington Terminus, on Monday, 26th April. The secretary's report was highly satisfactory, showing a continued increase in the number of members. The library circulation amounted to about 10,000 volumes, being an increase of 3,000 over the preceding year. Nearly 70 per cent. of these consisted of works on philosophy, history, biography, physical science, &c. The treasurer's report showed that, after a liberal expenditure for books and all other necessary requirements of the Society, a considerable balance remained in hand. During the past year Sir Watkin Williams Wynn, Bart., has presented the Society with the sum of £60, which has been expended in the purchase of standard works. A most valuable addition to the library has been made by J. H. Bertram, Esq., who has presented the whole of "Blackwood's Magazine" from its commencement. The cordial thanks of the members were accorded to these gentlemen, to the directors of the company, and to the proprietors of the London and country press, for their valuable assistance; and the success attendant upon the efforts of the officers of the Society called forth warm expressions of the members' appreciation of their exertions.

GREENWICH.—On Tuesday evening, the 27th April, owing to the sudden indisposition of Archdeacon Robinson, of the Temple, who was announced to lecture before the members of the Society for the Diffusion of Useful Knowledge, on the "Distinctive Character of Hebrew Poetry," Mr. W. C. Bennett accepted an invitation to take his place, the subject chosen for the occasion being "Songs and Song Writers." The lecture was highly appreciated by the audience.

SIDMOUTH.—The Annual General Meeting of the Institution was held on the 9th ult., J. G. G. Radford, Esq., in the chair. The Report congratulated the members on the approved convenience of their present premises, and the wise economy of previous years, which, aided by some liberal donations, had enabled them to meet the expenses connected with the change without incurring debt, or encroaching on the income of the year. Notwithstanding a decrease (attributable to various causes) in the number of annual subscribers, the statement of receipts and expenditure showed a balance in favour of the Institution of nearly £10 on the year. The Committee would be glad to devote some part of this surplus to the improvement of the circulating library, which they regard as the principal means of extending the benefits of the Institution to the homes of the less wealthy subscribers. In the late Mr. Henry Johnson the Institution had lost not only an early and generous friend, but a zealous and efficient treasurer. So long as there was any chance of his resuming this office the Committee were reluctant to appoint any other in his place; this duty would now devolve upon the meeting. The views taken by Mr. Johnson in Italy formed the nucleus of the collection of photographs which had recently been exhibited to the public. The Committee wished it to be generally understood that their object was not to add to the funds of the Institution, but to gratify the taste and contribute to the pleasure of all their fellow-townsmen. After the reading of the Report, the election of officers took place, and the meeting separated after passing several votes of thanks.

MEETINGS FOR THE ENSUING WEEK.

MON. ......British Architects, 8. I. Rev. R. Burgess, "On the Egyptian Obelisks in Rome, and Monoliths as Ornaments of Great Cities." II. Mr. J. Bell, "On the Application of the Entasis to the Obelisk."
United Service Inst., 8½.

TUES.......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Photographic, 8.

THURS. ...Zoological, 3.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8. I. Mr. Kynaston, "On the Composition and Analysis of Block Ash or Ball Soda." II. Mr. Guthrie, "On Nitrate of Amyl and its derivatives."
Philological, 8.

FRI..........United Service Inst., 3. Mr. Montagu Gore, "On the Military Character of Sir John Moore."
Archæological Inst., 4.
Royal Inst., 8½. Prof. Tyndall, "On the Mer de Glace."

SAT..........Asiatic, 2.
Actuaries, 3. Anniversary.
Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 12th May, 1858.

235. Sugar—Return.
236. Foreign Sugar—Account.
245. County Courts—Return.
262. Harbours of Refuge—Return.
263. Treasury Chest—Account.
368. Ecclesiastical Commission—Return.

Delivered on 13th May, 1858.

79. Bills—Chelsea Bridge Act Amendment.
80. ——— Stanhope and Walsingham Rectories.
82. ——— Election Committees Scrutiny.
Constantinople and Bassorah (Line of Telegraph) Correspondence.

Delivered on 14th May, 1858.

83. Bill—Stamp Duty on Passports.

Delivered on 15th and 17th May, 1858.
189. Bankruptcy—Returns.
272. East India Company—Return.
201. (11) East India (Revenues, &c.)—Return of Amount of Government Stock in India, &c.
260. Shipping—Returns.
273. East India (Governor-General)—Copy of a Letter.
81. Bills—Prescription (Ireland) (No. 2).
84. ——— Prince Edward's Island Loan.
85. ——— Common Law Procedure Act Amendment.
The Excavations at Budrum—Further Papers.
Superannuation Act—Supplemental Report of the Commissioners.

Delivered on 18th May, 1858.
149 (1). Metropolis Rates—Return.
253. East India (Press)—Return.
271. Cooper *v.* Slade—Opinions delivered by the Judges.
72. Bills—Confirmation of Executors, &c.
86. ——— London Corporation (as Amended by the Select Committee).
87. Bills—Chancery Amendment (as Amended in Committee, on Re-commitment, and on Consideration of Bill as Amended).

Delivered on 19th and 20th May, 1858.
266. Exchequer—Account.
280. Beer—Account.
281. Income Tax—Return.
282. East India (Governor-General)—Return.
Public General Acts—Cap. 10, 11, 12, 13, 14, 15, and 16.

Delivered on 21st May, 1858.
118. Local Acts (35. Hesketh Marsh)—Admiralty Report.
274. War Department—Returns.
277. Prideaux Furnace Valve Door—Report by Mr. Murray.
286. Guaranteed Loans (Colonies)—Return.
261. Colonization and Settlement (India)—1st Report from Committee.
289. East India (Oude Proclamation)—Copy of Letters.
90. Bills—Game Laws (Ireland).
91. ——— Poor Removal Law Amendment.
92. ——— Friendly Societies Act Amendment.
93. ——— Hainault Forest (Allotment of Commons) (as amended by the Select Committee).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 21, 1858.]

Dated 22nd April, 1858.
880. W. Bishop, Boston, Lincolnshire—Imp. in machinery or apparatus for ticketing or labelling spools, bobbins, or reels, for adjusting the size thereof for sampling patterns, for printing labels or tickets, affixing postage or other stamps or labels, for cutting their edges, and dividing them into given quantities and sizes.
883. J. Chatterton, 7, Devonshire-street Islington—Imp. in combining and coating insulated metal conductors for electric telegraphs.

Dated 26th April, 1858.
918. W. A. Martin, 16, Powis-street, Woolwich—An improved shoe scraper.

Dated 28th April, 1858.
948. L. Tapié, Bordeaux (France)—Imp. in ship building.

Dated 3rd May, 1858.
981. J. A. Hartmann, Mulhouse, France—Imp. in preparing and combining colours for printing cotton cloth.
983. S. Etchells and A. Consterdine, Nottingham, and S. Cattell, Radford—A reversing water tube iron to work with single blast or double blast as occasion may require, and an arrangement of water tube irons and parts connected therewith.
985. J. Taylor, Roupell park, Streatham-hill, Surrey—Imp. in stoves and fireplaces.

Dated 4th May, 1888.
989. J. Swain, Hyde, and M. Swain, Dukinfield, Chester—Certain imp. in metallic pistons.
991. H. L. Meall, 3, St. Matthew's-place, Hackney-road—Imp. in spring fastenings suitable to be used for dresses, brooches, and other purposes.

Dated 8th May, 1858.
993. D. Thom and G. Phillips, Pendleton, Lancashire—Imp. in apparatus for bleaching and raising oil and fat.
995. W. Ross, Glasgow—Imp. in taps or valves.
997. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in signal and indicating apparatus for railways. (A com.)
999. W. S. Hollands, 5, Anchor-terrace, Mawbey-road, Old Kent-road—Imp. in extracting and purifying oils and fatty matters.
1001. T. Holstead, Carlisle—Imp. in machinery for the manufacture of certain articles of confectionary, which improvements are also applicable to the manufacture of biscuits and the like, and to other articles, from plastic substances.

Dated 6th May, 1858.
1003. J. Richards, Moorgate-street—Imp. in rotary pumps.
1005. J. S. Willway, Bristol—An improved arrangement of apparatuses for ringing bells.
1007. W. Heap, Oldham road Tool Works, Ashton-under-Lyne—Imp. in pipe joints or couplings.
1009. H. Ashworth, Prestwich, Lancashire—Certain imp. in machinery or apparatus for cutting hides or skins.
1011. J. Bridgman, Hamburgh—Imp. in cooling fluids, and in the application of cold.
1013. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of saltpetre. (A com.)
1015. J. Wright, 10, Alfred-place, Newington Causeway, Southwark—Imp. in treating madder for printing and dying, and also in the substances and processes used in printing and dying with the same. (A com.)
1017. W. Willis, W. Langford, and J. Slack, Nottingham—Imp. in pressure guages.

Dated 7th May, 1858.
1019. C. J. Carr, Wentworth, Yorkshire—Imp. in forge and other hammers.
1021. R. Openshaw, Firwood, near Bolton-le-Moors, Lancashire—Imp. in machinery for plating down or folding and measuring fabrics.
1023. J. M. Duvard, Luc sur Mer, Calvados, France—An improved bed-room vase.
1025. A. Neilson, Glasgow—Imp. in the manufacture of boots, shoes, and other coverings for the feet.
1027. G. B. Coggan, 108, Friar-gate, Derby—A new portable apparatus to be called a stereoscopia, for exhibiting stereoscopic pictures.
1029. R. Best, Birmingham—An imp. or imps. in illumination.
1031. D. Stothard, Lambeth, J. Jones, Southwark, and D. Jonas and B. W. Jonas, Spitalfields—An improved ships' block.

WEEKLY LIST OF PATENTS SEALED.

May 21st.
2922. W. A. Cooper.
2929. S. Riley.
2932. C. Barlow.
2934. D. Hulett.
2939. W. Searby.
2940. C. Sands.
2944. F. H. Maberly.
2958. S. B. Wright and H. T. Green.
2970. J. Nichols.
2976. D. K. Clark.
2982. J. Young.
3018. W. Mercer, W. Bodden, and W. Higginson.
3032. G. Holcroft and G. Denholm.
3132. G. T. Bousfield.
3160. G. W. Hart.
3176. J. T. Griffiths.
3184. J. Blake and R. D. Kay.
158. W. T. Fox.
269. G. W. Burton.
362. J. Henderson.
372. A. Applegath.
404. W. E. Newton.
478. F. C. Warlich.
516. A. V. Newton.
560. A. V. Newton.

May 25th.
2954. J. Ruston and J. T. Proctor.
2955. J. Higham and G. D. Bellamy.
2961. A. Vandeleur.
2964. A. A. Chassepot.
2971. H. Deacon.
2975. R. A. Brooman.
3001. E. Slack.
3005. J. Buchanan.
3083. W. Galloway and J. Galloway.
3191. A. V. Newton.
183. J. Haste.
357. W. E. Newton.
548. W. Ward.
605. W. E. Wiley.
655. W. A. Gilbee.
657. W. A. Gilbee.
675. B. Wood.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

May 18th.
1139. I. J. Silbermann, junr.
1153. G. Collier.
1157. J. J. Meyer.

May 19th.
1127. W. H. Tucker.
1161. D. L. Davis.
1224. J. B. Acklin.

May 20th.
1126. R. J. Stainton and E. C. Davey.
1131. P. F. Didot.
1140. A. F. Cossus.
1147. J. Shanks.
1148. J. H. Johnson.

May 21st.
1315. J. S. Nettlefold, E. J. Nettlefold, and J. H. Nettlefold.

May 22nd.
1156. J. Morgan.
1167. J. A. Longridge.
1170. J. Park.
1185. J. H. Poullain.
1195. W. S. Young.
1199. C. W. Harrison.
1454. A. E. L. Bellford.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4090	May 21.	Portmanteau Trunk or Box	N. McCann	378, Euston-road.
4091	,, 22.	Deep Well Pump	T. G. Messenger	Loughborough.
4092	,, 25.	The Multum in Parvo Bath	J. Oxley	Camden-town.

Journal of the Society of Arts.

FRIDAY, JUNE 4, 1858.

MEETING OF COUNCIL.

The following Institution has been taken into Union since the last announcement:—

Clerkenwell Working Men's Institute.

SEVENTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Seventh Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on Thursday, the 24th of June, at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairman of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference, as matters connected with the arrangements for the next year's Examinations will, amongst other subjects, be brought under consideration.

ANNUAL DINNER.

The One hundred and fourth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Thursday, the 24th instant, at half past five for six o'clock punctually.

EXAMINATIONS.

On Saturday last, the Examinations for this year were concluded. The total number of examination papers sent to various parts of the country was 767. These papers were worked under the superintendence of thirty-nine Local Boards. Returns have been received from every Board, and are at present in the hands of the Society's Examiners. When the judgment of the Society's Examiners has been submitted to the Council, the result, as far as the award of the prizes and certificates is concerned, will be immediately communicated to each candidate, and to the secretaries of the Local Boards.

WRITING CASE.

The Council regret that, after a careful examination by the Committee specially appointed to report on the merits of the sixty-two writing cases sent in to compete for the Special Prize of Twenty Pounds and the Society's Silver Medal, there are none which show sufficient merit to justify the Council in awarding the Prize. The Council have decided to invite further competition, and will shortly be prepared to announce the conditions.

ARTISTIC COPYRIGHT.

The following Petition from the Society of Arts is about to be placed in the hands of Lord Lyndhurst for presentation to the House of Lords:—

To the Right Honourable the Lords Spiritual and Temporal of the United Kingdom of Great Britain and Ireland in Parliament Assembled.

The humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, incorporated by Royal Charter,

Sheweth,—That in consequence of the defective state of the laws of Artistic Copyright, the Council of the above-named Society, in December last, appointed a Committee for the purpose of inquiring into the state of the Law respecting Copyright in works of the Fine Arts.

That that Committee was composed of the most distinguished Painters, Sculptors, Architects, Engravers, Photographers, Publishers, purchasers of works of Art, and several Barristers and Solicitors.

That that Committee has held many meetings, all of which were numerously attended; and, on the 24th day of March last, presented a Report, in which are pointed out the defects in the existing laws affecting Copyright in works of Fine Art, as well as such remedies as appear to the Committee best calculated to amend the same.

Your Petitioners therefore humbly pray that it may please your Right Honourable House to consider the grievances in question, and to afford such relief as to your Right Honourable House shall seem just and advisable.

And your Petitioners will ever pray, &c.

Sealed with the Corporate Seal of the Society for the Encouragement of Arts, Manufactures, and Commerce, this twenty-ninth day of May, 1858.

(Signed)
C. WENTWORTH DILKE,
Chairman of the Council.
P. LE NEVE FOSTER, Secretary.

In addition to the above, the following Petition, signed by members of the Artistic Copyright Committee of the Society, as well as by a large number of gentlemen interested in the production of works of Fine Art, will also be presented by Lord Lyndhurst:—

To the Right Honourable the Lords Spiritual and Temporal of the United Kingdom of Great Britain and Ireland in Parliament assembled.

The humble Petition of the undersigned Painters, Sculptors, Architects, Engravers, Photographers, Publishers, and other persons interested in the production of works of Fine Art,

Sheweth,—That in consequence of the defective state of the laws of Artistic Copyright, the Council for "The Society for the Encouragement of Arts, Manufactures, and Commerce," by their minute of the 2nd day of December, 1857, appointed a Committee for the purpose

of inquiring into the subject of Copyright in works of the Fine Arts.

That by the Report of such Committee as made to the Council, it appears that at their first meeting the Committee appointed Sir Charles Eastlake, President of the Royal Academy, their Chairman, John Lewis, Esq., (late President of the Society of Painters in Water Colours,) Deputy Chairman, and Roberton Blaine, Esq., Barrister-at-law, Reporter.

That in addition to those gentlemen the Committee was composed of about sixty others, including Painters, Sculptors, Architects, Engravers, Photographers, Publishers, purchasers of works of Art, and several Barristers and Solicitors.

That prior to making their Report the Committee held ten meetings, which, upon all occasions, were numerously attended.

At one of such meetings the following resolutions were passed:—

"I. That the existing laws of British Artistic Copyright are exceedingly defective and unjust. The chief defects are—

1. That they afford the producers of works of Art no sufficient protection against the piracy of their productions.
2. That the purchasers of such productions are equally unprotected, and their property therein liable to invasion and injury.
3. That in consequence of this defective state of our laws of Artistic Copyright, direct encouragement is given to the extensive manufacture which is carried on of spurious copies of works of Art, which copies are extensively sold as originals, to the serious injury of the fame of the authors of such original works, the pecuniary loss of the purchasers of the spurious copies, and the demoralization of the young or needy artists employed to manufacture such copies.
4. That our Artistic Copyright laws are unjust in their operation upon the subjects of those foreign states who have entered into International Copyright Conventions with Her Majesty, inasmuch as such treaties are based upon the principle of reciprocity, and that while under those treaties the works of British Artists first published in the British dominions are protected from piracy within the territory of the foreign State named in any such treaty, no similar protection is afforded in the British territories in respect of the works by artists of such foreign States.

II. That the interests of Art and Artists, as well as of the public, require that the laws of British Artistic Copyright should be amended."

And by their Report the Committee also suggested such remedies as appeared to them best calculated to amend the defects of the existing Copyright laws.

May it therefore please your Honourable House to consider the grievances in question, and to afford such relief in the premises as to your Lordships shall seem most just and advisable.

And your Petitioners will ever pray, &c.

This Petition will remain at the Society's House till 4 o'clock to-morrow (Saturday), to receive the signatures of members of the Society and others interested in the subject.

THE MULREADY DRAWINGS.

The Council having decided on presenting the Mulready Drawings to the nation,* the following is the correspondence which took place between the Council of the Society and the Trustees of the National Gallery:—

* See present Vol. of *Journal*, page 237.

I.

Society of Arts, Manufactures, and Commerce, Adelphi, W.C., 19th Feb., 1858.

Sir,—I am directed by the Council of this Society to request that you will be good enough to bring before the Trustees of the National Gallery the desire of the Council to present to them three Drawings by Mr. Mulready, R.A., studies from the life, two in chalks, and one by the pen.

Some few years since the Society of Arts proposed to assist in the formation of a National Gallery of British Art, and to raise funds for that purpose by holding annually an Exhibition of the works of some one eminent living artist.

In 1848 the works of Mr. Mulready were exhibited by the Society, but the surplus funds, after payment of the expenses, did not amount to a sum sufficient for the purchase of a picture by Mr. Mulready, as had been intended in the first instance.

Mr. Mulready, however, has with great liberality presented to the Council the three Drawings in question, in return for the surplus which was handed to him, a sum totally inadequate as representing the value of the Drawings, which the Council believe are well worthy the acceptance of the National Gallery as studies which have been rarely equally in ancient or modern times.

The Council have much pleasure in offering them for the acceptance of the Trustees upon the following conditions, viz.:—

"That when they are not publicly exhibited in London, they may be lent by the Trustees to Local Schools of Art for limited periods, for the purposes of instruction, under such restrictions as the Trustees may consider necessary."

The Drawings may be inspected at the Society's House any day after the end of this week.

I have the honour to be, Sir,
Your obedient servant,
(Signed) P. LE NEVE FOSTER,
Secretary.

Sir Charles Eastlake, P.R.A., 7, Fitzroy-square.

II.

National Gallery, 2nd March, 1858.

Sir,—In reply to your letter of the 19th ult., respecting the conditional presentation to the National Gallery of three Drawings by Mr. Mulready, R.A., I have been instructed by the Trustees to state that they recognise the liberality of the Society of Arts, and would gladly accept the donation offered; but they do not deem it to be consistent with the duties which they have undertaken, to consent to have their trust qualified by the conditions proposed.

I have the honour to be, Sir,
Your very obedient servant,
(Signed) R. N. WORNUM,
Secretary.

P. Le Neve Foster, Esq., Secretary, Society of Arts.

III.

Society of Arts, Manufactures, and Commerce, Adelphi, W.C., March 11th, 1858.

Sir,—The Council of this Society have had under their consideration your letter of the 2nd inst., in which you state that the Trustees of the National Gallery would gladly accept the donation of the three Drawings by Mr. Mulready, R.A., but cannot consent to have their trust qualified by the conditions proposed in my letter of the 19th ult.

The Council have directed me to say that they have much pleasure in presenting the three Drawings to the Trustees.

I shall be obliged by your informing me when it will be convenient to receive them.

I am, Sir, your obedient servant,
(Signed) P. LE NEVE FOSTER,
Secretary.

R. N. Wornum, Esq., National Gallery.

IV.

National Gallery, 4th May, 1858.

Sir,—I am instructed to desire that you will be pleased to express the thanks of the Trustees to the Council of the Society of Arts for the donation to the National Gallery of the three valuable studies of William Mulready, Esq., R.A., which are now exhibited with the other works of the British School at Marlborough House.

I am, Sir, your obedient servant,
(Signed) R. N. WORNUM.

P. Le Neve Foster, Esq.

ICE MAKING.

A patent was taken out some time since by Mr. Harrison, of Victoria, for the making of ice, or rather, following the title of the patent, "for producing cold by the evaporation of volatile liquids in vacuo, the condensation of their vapours by pressure, and the continued re-evaporation and re-condensation of the same materials."

The invention consists in producing cold by the evaporation of a liquid in one vessel, the withdrawal of the vapour formed, and the getting rid of the heat thus withdrawn by the condensation of the vapour in another vessel, such condensation being effected by pressure, and the heat given out during such condensation removed by the vessel being surrounded by water, the condensed liquid being again available for evaporation; the whole process being conducted in vacuo, that is to say, the liquid and vapour being isolated from the pressure of the atmosphere. The evaporating vessel may be of tinned copper, or any air-tight and water-tight material of good heat-conducting power, capable of resisting the atmospheric pressure, and not acted upon by the substances in contact with it, and of any shape, provided there be a sufficient surface of contact respectively to the liquid to be evaporated and the substance to be cooled. In like manner the condensing vessel may be of any material and shape, the requisites of strength, conduction of heat, resistance to chemical action, and sufficient surface, being attended to.

The apparatus by which the vapour is to be withdrawn from one vessel and forced into the other may consist of a double-acting air pump, a double-acting pump with a piston of a half drum or gasometer shape working freely in an annular space filled with mercury; a blowing fan enclosed in an air-tight vessel, or a series of blowing fans; or the vapour may be forced under a head of mercury, and delivered on the other side of a partition, where the mercury is kept at a lower level by the increased tension of the compressed vapour, by means of a diving bell, a reversed archimedean screw, that is to say, a screw in which the spiral turns in the opposite direction to that in which it would raise water, so that it scoops in and carries down the vapour and delivers it behind the partition; or by a reversed overshot wheel; or generally the vapour may be depressed by reversing any of the ordinary means whereby liquids are raised.

As this invention is applicable to the production of various degrees of cold by the evaporation of any volatile liquid, it is impossible to specify the dimensions of the various parts of the apparatus suitable for the endless variety of conditions under which it may be worked. Mr. Harrison supplies the following data for the calculation of dimensions as a guide to persons conversant with the leading principles of heat, and the chemical and mechanical properties of the substances made use of or operated upon.

The requisite surface of the evaporating vessel, he says, may be deduced from the ascertained fact, that a surface of 10 square feet will evaporate fully 1 lb. water per minute, with a difference of temperature of 30°; with a less difference a proportionately larger surface will be required. The latent heat of other liquids being less than that of water, a less surface will suffice for their evaporation. For instance, the latent heat of ether at, say 24°, is to that of steam at 212° as 200 to 1000, nearly, therefore only one-fifth of the surface, or one-fifth of the difference of temperature, will suffice for the evaporation of ether. The same rule will apply to the condensing vessel; but as no loss except of space can accrue from having the vessels much larger than is by calculation necessary, it will be well to make them of ample capacity and surface.

The method of ascertaining the dimensions of a pump to withdraw and compress a given quantity of vapour in a given time and at given temperatures, and of the power required to work such pump (in addition to the loss accruing from friction and the power required to overcome the weight of the valves, &c.), may be illustrated by the following calculations for an ether-evaporating apparatus:—It has been ascertained by experiment that 100 cubic inches of air weigh 31 grains, so that one pound of air occupies 22,580·6 cubic inches. The vapour of ether at 96° is of specific gravity 2·56, so that one pound of it occupies 8,820·55 cubic inches. The force or tension of ether vapour at (say) 24°, is equal to 4·8 inches of mercury, and as the specific gravity is proportional to the tension, one pound of vapour will occupy 55,125 cubic inches. But a condensation takes place on account of the lowness of the temperature amounting to $\frac{1}{480}$ of the volume at 32° for each degree. Corrected by this amount, one pound of ether vapour at 24° occupies 47,935 cubic inches. To withdraw and condense this quantity per minute, a pump of, say, 500 cubic inches capacity, making 48 strokes, would be required. The power required to work such a pump is the difference of tension between the vapour at the temperature of evaporation and its tension at the temperature of condensation; thus, the tension of ether vapour at, say, 24°, being equivalent to 4·8 inches of mercury, and its tension at, say, 74° being equivalent to 16·1 inches, the power required to raise vapour at the former and condense it at the latter temperature will require to be sufficient to overcome a tension equal to 11·3 inches of mercury. As, however, the vapour of ether under a pressure of 16·1 inches occupies only ·32 of its volume at 24°, the full power will not be required until the vapour has acquired the full density, and only one-half of the power will be required to reduce the volume of vapour at 24° to its volume at 74°. The power therefore required to raise one pound of ether at 24° and condense it at 74° is equal to the compression of 15,520 cubic inches (the bulk of the vapour at 74°), $+ \frac{47935-15520}{2} = 31,722{\cdot}5$ cubic inches, with a weight of 11·3 inches of mercury, or about 5·7 lbs. per square inch.

It is impossible, without the aid of drawings, to give a more detailed description of the invention. The inventor does not, however, confine himself to the use of the special arrangements of apparatus described in his patent, but he claims in his invention the use of volatile liquids (including water) evaporated in vacuo, and reduced to the liquid form in a separate vessel by pressure, for the production of cold and in the manufacture of ice, and, generally, in all processes where refrigeration is requisite or desirable. An apparatus, driven by a steam-engine of 10 horse-power, has been erected, and successful experiments were publicly made in the working of the invention, previous to the exportation of this apparatus to Australia. The question to be solved is not whether ice can be made by the machine,—of that there is no doubt whatever,—but at what cost. Experience alone will determine this.

MUSIC PRINTING.

A patent was obtained a few months since, by Mr. Scheurmann, the music publisher in Newgate-street, for a new method of printing music, invented by him. The invention is calculated to have an important bearing in the production of printed music.

It is well-known that the present comparative cheapness of musical publications has been caused by the adoption of type-printing as the substitute for engraving. By this means, editions of standard works of large circulation, such as Handel's Oratorios, &c., are now sold at prices which a few years ago would have been considered impossible. But Mr. Scheurmann's invention will carry this advantage still farther. Even in the best of the present cheap publications (such as those of the Oratorios used at Exeter Hall) the immense number of separate pieces of type—in some instances between three and four thousand are employed in setting up a single page—cause a waste of time and labour, and, however carefully done, the printing has a disjointed and broken appearance. These objections are obviated by Mr. Scheurmann's mode of setting up the lines and the notes on two separate plates, the whole of one stave forming a single piece of metal, and the notes also being solid. The result, independently of the great diminution of labour, is a clearness and sharpness of appearance. The lines and notes being thus separately set up, in order to avoid the necessity of double printing a cast is taken of the notes, and into the mould thus obtained the frame containing the lines is pressed. A matrix combining the two plates is thus formed, which, after a conducting surface has been given to it, is then placed in a galvanic trough, where it receives a thin shell of copper of a few ounces weight, obtained by the electrotype process; and the plate, being backed with lead, is ready for printing.

Mr. Scheurmann states that, on an average, only one-tenth of the number of types at present in use will be required by the new method, followed by a proportionate diminution in the cost of production, and a corresponding reduction in the present price of music. The process admits of the music being transposed to any key by simply altering the signature and raising or depressing the frame containing the lines, without the necessity of resetting a single note. Another striking consideration is the facility with which a plate of music once formed in the manner described, may be multiplied by the simple expedient of taking casts from it.

ROYAL SOCIETY OF ARTS OF JAMAICA.

The following notice has been issued by the Society of Arts of Jamaica:—

The Council of the Royal Society of Arts of Jamaica, alive to the necessity of submitting, if not with cheerfulness, at least with resignation, to the decision of the Honourable House of Assembly, that the Society, to whose principles of improvement they are collectively and individually pledged, shall not receive any Legislative pecuniary support, for the present year, deem it a duty to lay before the members of the Society, the anticipated results of their altered position, and the steps they have taken, and intend to take, while the cloud is passing.

Disavowing now, as they have always disavowed, not only the design, but the inclination, to intrude within the confines of politics, the Council will not further enter into any defence, either of their principles or their proceedings.

It is with great satisfaction that the Council announce to the members of the Society that, although they had calculated on the Legislative grant, which has been withheld, still they have not anticipated their expenditure. The result of this caution is, that while they are suddenly driven to suspend many of their most active operations for the present, their balance-sheet, at the close of the past year, shows them free from debt. For this they have to thank the Royal bounty, the substantial patronage of distinguished individuals (both at home and abroad), the former liberality of the Honourable House of Assembly, and their own Members—negligently and indifferently, as they are compelled to say, many of this last class have acted in paying up their annual subscriptions.

The Council have no intention whatever of closing the doors of the Society; but, as they have no source of income at present, beyond that which their own subscribers are pleased to afford them, and as they are determined to maintain the honour of the Society, by maintaining its credit, they have been constrained, on economical grounds, to suspend the active operations of the Society to the following extent until further notice:—

First—The publication of the Transactions will be discontinued.

Second — There will be no Annual Exhibition for 1858.

Third—No Prizes will be offered for competion.

Fourth — The Annual Contracts with the Public Press for Advertisements, have been withdrawn.

As it is the earnest desire of the Council that the public should feel as little as possible the consequences of their straightened circumstances, the Museum will be kept open as heretofore, and the Council will be rejoiced to find that, while they are not able to purchase desirable additions, their inability to do so may be beneficially countervailed by private contributions, the fruits of individual enterprise.

The Council deprecate any desire to be exclusive in their proceedings. They invite now, as they always have invited, the co-operation of every class in the community, without exception. They will continue to make it their duty, as it is their inclination, to conciliate their fellow-colonists in every station in society; and they will at all times feel grateful for the honest comments of an enlightened Press.

Kingston, Jamaica, February 1858.

(Signed) Wm. Irving Wilkinson, V.P.; R. Hill, V.P.; R. A. O'Reilly, V.P.; James Watson, V.P.; Thomas Stewart, D.D.; L. Q. Bowerbank, M.D.; Charles Campbell, M.D.; John Radcliffe; John Daughtrey; John Nethersole; David Ewart; W. T. March; Alexander Barclay; Jonathan Edmondson; R. J. C. Hitchins; H. J. Kemble; J. A. Garcia del Rio, Secretary.

YORKSHIRE UNION OF MECHANICS' INSTITUTES.

The twenty-first annual meeting of the Yorkshire Union was held at Selby, on Wednesday, the 26th ult. The annual conference of the delegates was held in the public room, under the presidency of Edward Baines, Esq., President of the Union, and commenced at eleven o'clock.

The Chairman, in opening the proceedings, congratulated the delegates on their again meeting in undiminished numbers, at the ancient town of Selby, the Mechanics' Institution of which had been connected for many years with the Yorkshire Union. The number of Institutions connected with the Union was slightly less than at their last anniversary, but the number of members was greater. Last year the number of Institutions in Union was 130—this year it was 127, representing 22,600 members, which was several hundred more than they had had at any former period. In most of the reports received, complaints were made of the effect produced by the recent depression of trade, and the diminution of members was in some instances ascribed to that cause, but, notwithstanding that depression of

trade, it was remarkable how well the number of members had been kept up. The most pleasing feature, perhaps, in the report, was the increase of the number of pupils attending the evening classes, and the increased steadiness of attendance at those classes. After speaking of the importance of providing improved buildings for the Institutions, the chairman proceeded to explain the alterations which had taken place in the Society of Arts Examinations, and remarked that, though the feelings of the Committee, as well as of the Institutions in the Yorkshire Union, were in favour of the former mode, it had been determined to give the new scheme every support, and local boards had been established in various places with that object. In conclusion, Mr. Baines said he was happy to find, from the report of their agent, who had been most laborious during the year, that the Institutions of Yorkshire were never in a better state than at present.

Mr. HOLE read the annual report. The Committee expressed their pleasure in again meeting the delegates and friends of the United Institutes, and then continued:—

"The reports furnished by the Institutions enable your Committee to supply the following details of their operations and progress for the past year:—

Number of Institutes in the Union	127
Last year, 130; ceased to exist, 7; withdrawn, 7; new Institutes joined	12
Total number of members estimated at . . .	22,600
Reports received from Institutes	105
Number of members in 102 Institutes—Males, 18,219	
" " " Females, 1,915—	20,134
Annual Income of 89 Institutes	£11,453
Number of Volumes in the Libraries of 99 Institutes	109,176
Number of Issues of Books in 87 Institutes . .	281,535
Number of Issues to each Member	16
Number of Books added during the year to 88 Institutes (Being an increase of 8·5 per cent.)	9,292
Number of Periodicals taken in 93 Institutes:—	
Weekly 227	
Monthly 548	
Quarterly 68	
	843
Newspapers	826
Number of Lectures delivered at 85 Institutes . .	566

Of which 146 were paid, and 420 gratuitous, and they have been classified as follows:—

Literary	362
Scientific	163
Musical	41
	—566

In 83 Institutes, containing 17,670 members, the number of pupils belonging to classes is returned	7,422

COMPARATIVE TABLE.

	1857.	1858.	Increase. No.	Increase. p.ct.	Decrease. No.	Decrease. p.ct.
Members in 94 Institutes	17,785	18,913	1,128	6.4		
Do. 48 do. ...	10,003	11,937	1,934	19.3		
Do. 42 do. ...	7,290	6,484	...	...	806	11.0
Females in 48 do. ...	1,121	1,380	259	23.1		
Income of 84 do. ...	£10,040	£10,915	£875	8.7		
Periodicals in 79 do. Weekly	172	192	20	11.6		
Monthly..	511	483	...	...	28	5.5
Quarterly	69	62	...	...	7	10.1
Newspapers	652	679	27	4.1		
Lectures at 70 Institutes... Paid	120	137	17	14.1		
Unpaid	481	349	...	...	132	27
Books in Libraries of 99 Institutes	99,884	109 176	9,292	8.5		
Issues in do. 70 do	252,213	252,322	110			
Pupils in classes of 59 do.	5,471	6,008	537	9.8		

"These figures are gratifying in an especial manner, because they show that in spite of the very great depression in trade, and consequent want of employment, the Institutes have not merely not suffered, but have made an actual average increase of six per cent. in numbers, and eight per cent. in funds. The reports from several Institutes ascribe to this depression their want of progress during the past year, but it is clear from the above figures, that the badness of trade has not operated either so greatly or generally on educational interests as might have been anticipated. In fact, a time of very good trade is quite as likely as one of very bad trade to be detrimental to the prosperity of educational institutes. The latter may somewhat deduct from the pecuniary means of the working classes, though the very small contribution required as the subscription to these Institutes scarcely renders such a plea admissible. On the other hand, seasons of active trade stimulate the national tendency to overwork, and by protracting the hours of business beyond reasonable limits, destroy at once the opportunity and the inclination for intellectual pursuits."

There was indeed little doubt that the indirect and external influences of these societies were quite as great and beneficial as their direct effects; and if further proof were wanted of the hold which Mechanics' Institutes had gained upon the public mind, it might be found in the fact that at least twenty-five of the institutions of Yorkshire have erected buildings specially adapted for the purpose, while at several places—among others, Huddersfield, Holbeck, Selby, Mossley, Marsden, and Dewsbury—endeavours were now making to raise funds to secure the same object. The Committee heartily hoped that these efforts would be successful, and that the respective societies would receive the cordial co-operation of the friends of education in the various localities.

After some discussion in reference to one or two of the subjects especially alluded to in the report, a resolution was passed to the effect—

"That the following gentlemen form the Central Committee of the Union for the ensuing year:—Edward Baines, Esq., Leeds, president; Henry Oxley, Esq., Leeds, treasurer; Mr. John Hope Shaw, Mr. Jas. Kitson, Mr. Thomas Wilson, Mr. W. S. Ayrton and Rev. Thomas Hincks, Leeds; Rev. J. H. Ryland, Bradford; Mr. W. Crowther, Gomersal; Mr. Wm. Marriott, Huddersfield; Mr. John Crossley, Halifax; and Mr. John Binks, Wakefield. Mr. James Hole and Mr. James Kitson, jun., honorary secretaries; Mr. Isaiah Dixon, honorary secretary and treasurer of the Village Library; and Mr. Barnett Blake agent and lecturer."

The place of meeting for 1859 was then considered, and Rotherham was fixed upon by a large majority.

The Rev. Mr. WARD, of Holbeck, moved that the thanks of the meeting be given to the Society of Arts, for the stimulus given to class instruction in the Union by the annual examinations and the awarding of prizes and certificates.—Mr. PRITCHARD, of Hunmanby, seconded the motion, which was unanimously passed.

The meeting next entered upon the consideration of various subjects for discussion.

The CHAIRMAN first invited opinions upon the question, "Shall the Union recommend the institutions to prepare pupils next year for the examinations of the Society of Arts?"

After some discussion, the following resolution was carried unanimously:—

"That this meeting is of opinion that the institutes composing this Union should prepare as many pupils as they severally can for the next year's examinations by the Society of Arts, and is not without hope that the Society will reconsider its late decision respecting the mode of examination and the amount of subscription proposed to be required of the smaller institutes."

A vote of thanks was then passed to Mr. Baines.

On the termination of the morning conference, the delegates sat down to dinner at the Londesborough Arms. Lord Londesborough presided, and was supported by Lord Goderich, M.P., Sir W. M. Milner, Bart., R. M. Milnes, Esq., M.P., P. O'Callaghan, Esq., Edward Baines, Esq., and other gentlemen. Major Waud occupied the vice-chair.

A Soirée was held in the public room, at six o'clock. Viscount Goderich, M.P., in the absence of Lord Londesborough, presided. The hall was filled, all the delegates being present, and the general company included a considerable number of ladies. On the platform were Sir W. M. Milner, Bart., Col. Smyth, M.P., R. M. Milnes, Esq., M.P., Major Waud, P. O'Callaghan, Esq., George Leeman, Esq., Edwd. Baines, Esq., Mr. Lowther, president, and Mr. Cutting, vice-president of the Selby Mechanics' Institute, &c.

The CHAIRMAN, after expressing regret at the unavoidable absence of Lord Londesborough, said he believed

that the great spread of Mechanics' Institutions throughout Yorkshire of late years, and the high position which they now occupied among the institutions of the country, had been very much owing to the efforts of the Yorkshire Union. It had now been engaged in this work for upwards of twenty years; it had done much to promote the establishment of classes, and it was owing very much, he thought, to the existence of the Yorkshire Union, and to the efforts of its able and zealous president, Mr. Baines, that they had in Yorkshire last year public examinations held by the Society of Arts. He trusted that those examinations would be continued. He understood that the Society had made some alterations in their system, which he could not view with great favour, because it appeared to him that the system in force last year worked remarkably well and had in it many advantages. But because they might not altogether agree with the views of the Society of Arts, he thought they ought not to reject their assistance in this great work, for it appeared to him that examinations of this kind were the bond and complement of the labours of the Yorkshire Union—that they brought the institutes of the county into practical competition one with the other—that they threw them into a friendly rivalry with each other, and that they enabled them to know the real value of their efforts, and to compare the results of their respective exertions. Surely a body representing, as this Union did, this great educational effort in Yorkshire, able to communicate with societies learned and famous like the Society of Arts—and he only wished that the Society of Arts would attend a little more to its representations—an association of that description was just the thing wanted to complete the system of their Mechanics' Institutions, and to render them, from the isolated efforts of single individuals, a great organic whole.

Mr. R. Monckton Milnes, M.P., moved a resolution in favour of Mechanics' Institutions, speaking of their present favourable position, and particularly insisting upon attention being paid to the elementary branches of education.

The resolution was seconded by Major Waud, and carried.

Mr. Edward Baines then moved the following resolution:—

"That the continued progress of the Institutions comprised in the Yorkshire Union, as shown by the increase of members, and more particularly by the great extension of class instruction, affords the most satisfactory proof of the value and efficiency of the Union in promoting the successful working of these Institutions, and by the interchange of experience and systematic organisation rendering them of practical benefit to the great majority of the population: and the Union is therefore entitled to the continued and increased support of all who desire to promote the mental and moral welfare of the rising generation."

In the course of his address Mr. Baines gave various statistics, showing the present state of the Institutions in the Union, which proved it to be in a prosperous condition.

The resolution was seconded by Colonel Smyth, and carried.

The Rev. Mr. Ryland moved the third resolution, as follows:—

"That the examinations of the Society of Arts having proved successful in stimulating attention to the study of various useful branches of science and literature, this meeting desires to express its thanks to the Society of Arts, and its wish for the continued application of so valuable an aid to the operations of Mechanics' Institutes."

The Rev. R. Paver seconded the resolution, which was then adopted.

The Rev. T. B. Bensted moved a vote of thanks to the Committee of the Selby Mechanics' Institution, for the excellent arrangements which they had made for the annual meeting of the Yorkshire Union.

Mr. Cablile seconded the motion, which was carried with acclamation.

Sir W. M. Milner moved a vote thanks to the Chairman, which was seconded by Mr. Lowther, and carried.

Lord Goderich acknowledged the compliment, and the meeting separated.

SOUTH KENSINGTON MUSEUM.

During the week ending 29th May, 1858, the visitors have been as follows:—Morning, 10,764; Evening, 4,645. Total, 15,409.

Colonial Correspondence.

THE BOMBYX CYNTHIA.

Sir,—In a recent number received here of the Journal of your Society, there appears a copy of a despatch from the Governor of Malta, Sir William Reid, to the Secretary of State for the Colonies, on the subject of the *Bombyx Cynthia*, or Eria silkworm.* Knowing the interest that has generally been evinced in various quarters with respect to this insect, I would now beg leave to offer a few observations in the matter, with a view to publicity in the same Journal.

I am not aware whether the Eria is at present reared in any part of this island, or whether it is now altogether extinct here, although, on its first introduction from the British colony of Grenada, in 1856, it was very extensively propagated, with the aim, if possible, of the insect being turned to account in a commercial point of view. The breeding and rearing were found to be easy and successful enough, but the chief difficulty was with the cocoons, which appeared incapable of being wound off. In my own management of the worms, of which at the time I possessed several hundred, I early discovered that the moth, on emerging from the cocoon, did not cut or eat away the thread at the extremity, in order to free itself from its covering after the manner of the *Bombyx mori*. In fact, one end of the cocoon of the Eria, while the chrysalis is yet inside, will, on inspection, always be found to be open, and the silken thread nicely doubled over at that end; yet the unwinding is far from being of easy accomplishment, and although often attempted by myself, I never succeed in getting off more than a yard or so at a length without breaking. The like experience had many others, who consulted me upon the subject. Nevertheless, I entertained the opinion, which I communicated to those who sought for information, that the cocoons could be carded and spun, and thereby made available as a commercial product of some value; and which opinion, I am glad to find, is confirmed in the sixth paragraph of Sir W. Reid's despatch, where he states, that in France, as well as in Malta, the cocoons are so treated. He further remarks, that in France they have partially succeeded in unwinding the cocoons, and if it is really possible to do so readily, and in the entirety, there would no longer be a doubt of the true value of the Eria, and of its importance as a silk-producing insect. Under the conviction that, carded and spun, the cocoons would furnish a new raw material for thread and clothing, I sent to you, about the middle of last year, through A. F. Ridgway, Esq., a few thousand of the cocoons to be reported on; and this gentleman has lately informed me that you had placed them in the hands of competent persons for the purpose. Immediately I am made acquainted with the result, I shall be glad to give every publicity to it, for the information of any who may yet be rearing the insect, or inclined to do so, for the sake of profit; and I should, indeed, no less rejoice if thereby a way is opened up as an ad-

* See present Vol. of *Journal*, page 168.

ditional source of employment, and a means of livelihood to many of both sexes of our humbler classes, to whom the first would be an easy and agreeable task, and the second a positive boon in these impoverished days.

Before quitting this subject, I would simply remark, that the *Bombyx Cynthia* having, I believe, come from Assam, where I am led to understand the produce of the worm is used for the manufacture of some textile fabrics, is it not practicable to ascertain in what manner the cocoons are there turned to account

I would now proceed to touch upon another matter made public in the same number of your *Journal* already referred to. I mean the value of certain samples of pineapple and plantain fibres, in your possession, from Ceylon,* and which is suggestive of a few remarks relative to the fibres of this country.

The fibre question, as it has been termed here, constituted, some time back, the absorbing question of the day among us. Now, with the apathy, indifference, or fickleness, which unfortunately characterises most popular movements in this colony, it would appear to be unthought of, or to have yielded to some other temporary mania. It is not my present intention to inquire into the causes of this. Rather is it my hope that the matter is still receiving some share of steady public attention amongst our agricultural population, and that some parties are dedicating their means and time to develop this most important branch of commercial economy, and which presents a ready and a certain source of wealth to such as choose to pursue it in a proper spirit of energy and enterprise. It is well known that fibre of numberless kinds and qualities can be produced from various plants capable of being grown in any quantity in our fertile soil. This fact is incontestible, and is proved by the varied collection kindly prepared and presented by Nathaniel Wilson, Esq., the Curator of the Botanical Gardens in St. Thomas-in-the-East, existing in the Museum of this Society, and similar specimens whereof were sent by him, through us, to the Paris Exhibition; and also by the experiments of sundry private individuals. Neither does it require much argument to demonstrate the value of our fibrous produce, in a commercial sense, since the samples which from time to time have been forwarded from this island have attracted the particular attention of competent mercantile and other judges in the British and European markets, and have been pronounced fit for divers uses, and consequently of correspondent pecuniary worth. The value set upon the Ceylon fibres may be considered as corroborative evidence of the foregoing fact. If Jamaica, then, can yield as good or better fibres as can Ceylon, and prepared, too, from similar plants as those referred to, such fibre ought, surely, if properly got up, to command as high rates as those quoted for the Cingalese productions, and should afford some inducement for public attention here to be earnestly directed to this important subject. With this latter view, I have made public in our local journals the extract from your *Journal* relating to the Ceylon fibres.

A great desideratum required in this island, in the preparation of fibre for market, is a simple, economical, and efficient machine. I know that two or three ingenious individuals of our community are separately engaged at work in order to supply this want; and I trust that, ere long, the labours of one or other of them may result in complete and deserved success, and that Jamaica may, in this respect, soon triumphantly bear away the palm for inventive skill. Such a consummation would greatly tend to give an impetus to the production of fibre, and render it, probably, one of the permanently available articles of export from, as well as an additional source of wealth to, the colony.

* See present Vol., page 167.

Apologising for the length of the present communication,

I remain, &c.,
J. A. GARCIA DEL RIO,
Secretary.

Kingston, March 22, 1858.

Home Correspondence.

INDIAN SETTLEMENT.

Sir,—Mr. Hendriks' observations, in the last *Journal*, rather tend to the definition of his own views than the impugnment of mine. He admits the principle of the redemption of the land-tax or rent, under suitable circumstances, and I have advocated no more. My observations are chiefly directed to the attainment of a price for land in India, by the creation of freeholds, leaving the land rent to take the character simply of a land-tax, as in this country, or as corresponding assessments are carried out in the United States and elsewhere, leaving the holder with a full and free title, in no way dependent on the revenue system. It is difficult to see why India should be deprived of a freehold tenure.

I have not asserted that the normal rate of labour in India is a rupee per month, only that such a rate is to be found, and it is one which I consider inconsistent with the well-being of the population as consumers.

The stationary condition of the population, of prices, and of the rates of labour, during the last three centuries, assuredly is no more reason for refusing to believe in the capability of advance and improvement, than the assertions of the like facts with regard to Ireland. Whether faults may fairly be attributed to the administrators of India, the resources of the whole country are advancing to a degree far beyond anything realised in the historical period referred to, and evidences of enterprise are to be found everywhere throughout India. Although little remarked in this country, there are districts in India making a progress commensurate with that of Canada and the Western States of America, particularly in the table-lands and hill regions. The development of the resources of Assam, of late years, will bear a very fair comparison with many of our colonies and many parts of the States. Of course, old and populous parts of Bengal or Bahar are not to be subjected to such comparisons. It is dangerous to lay down, as a principle, that India is to be stationary, until we ascertain that the railways, steam-boats, roads, and postal system, and the promotion of agriculture, mining, and commerce, which have succeeded everywhere, all fail there.

With regard to the rise in prices and wages which must take place, it is difficult to affirm that India will be unable to compete with the United States in the growth of cotton, when the great obstacle to the production of cotton in India has yet to be removed by the provision of cheap and efficient means of conveyance. The occasional lowering of the price of food, in times of famine, may be looked for from improved means of conveyance, as Mr. Hendriks indicates, but a general lowering of the price of food is not to be looked for. Where food is now low, it is because there is no outlet for its sale, but every mile that it is moved to a market enhances its price, and cannot reduce it. Wherever a market has been opened for rice, for instance, within the last few years, the price has risen, and, indeed, in many districts of Bengal the price has advanced consequent upon the exports to China and Europe, and yet the whole of this export trade is but a small portion of the total produce of the country.

My paper was directed to the main subject of increasing the European element in India, and I am led, therefore, to perceive that Mr. Hendriks' objections go only to subsidiary and collateral points of my subject

though integral portions of that on which Mr. Hendriks has bestowed great labour, and which he has subjected to a searching analysis.

I am, &c.
HYDE CLARKE.

42, Basinghall-street, May 31, 1858.

Proceedings of Institutions.

Dover.—The Museum and Philosophical Institution held its annual general meeting on the 28th April (being its 22nd anniversary). The chair was taken by James Poulter, Esq., V.P., and the report was read by Mr. Phillips, honorary secretary. The reading-room is now supplied with six daily London newspapers, besides weekly papers and periodicals. About fifty volumes had been added to the library during the past year. The committee had made an unsuccessful attempt to obtain the grant of £15, to be given in books, maps, &c., from the "Peel Memorial Fund," three other Institutions having exhibited stronger claims. The plan of hiring a monthly supply of books from London, for the use of members, had met with entire success. There had been twelve lectures, as under:—On "The Writings of Douglas Jerrold," Mr. Applebee; an Exhibition of Italian Photographs from Rome, and a reading on them, Mr. L. Weston; the "Antiquities of Dover," Mr. Edward Knocker; "Charlotte Bronte," Mrs. Balfour; "Sir Walter Raleigh," Dr. Daniel; "Coal," Mr. Mackie; "Sleep, as described by the Poets," Rev. Peter Spencer; a Musical Entertainment, Mr. Doome; "Social History," Mr. Roberts; "Marine Natural History," Mr. J. R. Mummery; "Dissolving Views," Mr. Crow; "Fire with Experiments," Mr. Mockett. The museum had been attended during the year by between 10,000 and 11,000 persons. The Gnu or Horned Horse, from Africa, had been presented by the curator, Dr. Astley. Two Javan musical instruments, a map of Java, some Madrepores, and model of a Chinese coffin, by Mr. Millett, and some African birds, by Dr. Morgan. Since the last annual meeting, 42 members have withdrawn, and 32 joined the Society; the number now on the books is 140. An address to H.R.H. the Prince Consort, on the marriage of H.R.H. Princess Royal, to H.R.H. the Prince Frederick William of Prussia, had been signed by several of the members of the Institution and forwarded to the Society of Arts. From the treasurer's account, it appeared, that the income of the Society for the year had been £138 10s. 4d.; and the expenditure £125 16s. 3d., leaving a balance in hand of £12 14s. 1d. The election for officers and committee for the ensuing year next took place, when the Mayor was chosen president; James Poulter and George Thompson, Esqrs., vice-presidents; Mr. Phillips and Mr. Bottle, secretaries; Dr. Astley, curator; Mr. Crow, librarian; Mr. Penny, treasurer; and Mr. Rees, guardian of the apparatus. The committee were ballotted for. The six retiring members were, Mr. J. Biggs, Mr. J. C. Ottaway, Mr. George Thompson, Mr. Barton, Mr. J. R. Mummery, and Mr. J. B. Hambrook. Mr. J. Biggs and Mr. Ottaway were reappointed, and in lieu of the remaining four, the following gentlemen were elected:—Dr. Morgan, Mr. W. H. Payn, Mr. W. Knocker, jun., and Mr. J. Stilwell.

Redhill.—The last Report of the Institution records its continued progress. The number of subscribers at the present time is 170; 90 having been admitted during the year; 60 have left; leaving a net increase of 30. The number at the close of last year was 140. Two musical entetainments and sixteen lectures have been given during the year, seven gratuitous, and eleven at an expense to the Institution of nearly £32. The committee take the opportunity of specially acknowledging the kindness of those gentlemen who have so largely contributed to the interests of the Institution by their gratuitous services and lectures. The gratuitous lectures were—1. "On the Contents of the Library," by R. C. Carrington, Esq.; 2. "The Form and Dimensions of the Earth," by R. C. Carrington, Esq.; 3. "The Mountains of Switzerland," by Dr. Headland; 4. "Travels in Russia," by W. Klein, Esq.; 5. "Clocks and Watches—their History and Inventors," by Mr. Fowler; 6. "The great Tobacco Question," by Mr. Reynolds; 7. A Concert given by the Hungarian Brothers, for which members are indebted to the liberality of N. Wilkinson, Esq. The paid lectures were—1. Musical Entertainment and Lecture, by G. Buckland, Esq.; 2. "On the Curiosities of Insects," by J. N. Selway, Esq.; 3. "On the Honey Bee," by J. N. Selway, Esq.; 4. "On the Microscope and its Revelations," by J. N. Selway, Esq.; 5. "On the Sayings and Doings of the Anglo-Saxons," by G. Dawson, Esq.; 6. "On Sir Walter Raleigh," by Dr. Daniel; 7. "On the Romance of the Bourbons," by Dr. Daniel; 8. "On David Copperfield," by G. Grossmith, Esq.; 9. "On Thomas Hood," by W. Rowton, Esq.; 10. "On the Philosophy of Heat and Cold," by E. Wheeler, Esq.; 11. "On the Remarkable Women of the Nineteenth Century," by Mrs. Balfour. The library now contains 597 volumes, of which 127 by gift and purchase have been added during the year. The following is the number of each class of books issued during the year; Educational, 118—Biographical, 59—Poetical, 64—Historical, 44—Miscellaneous, 333—Novels, &c., 504—making the total number, 1,122; those of a light class, 504, and those of an instructive character, 618. The committee acknowledge, with best thanks, numerous donations to the library. The elementary class for writing and arithmetic, has been much better attended, and the discussion class has been recommenced. The class for instrumental music excites much interest. A class has also recently been formed for vocal practice and instruction. The best thanks of the committee are due to the Right Honourable Lord Monson, for his kindness in throwing open his grounds and mansion to the members and their friends, on the occasion of the fete, which was most successful.

Sherwood (Battersea) Mutual Improvement Society.—The fifth annual report, recently published, states that the library, which at the commencement of the year contained 588 volumes, now numbers 810, being an addition of 222. The number of books lent out for home reading during the year was 1600. Three volumes of great interest have been presented to the library by the president, G. F. Wilson, Esq., F.R.S., also two volumes on the "History of British India," by the author, J. M. Ludlow, Esq. During the season seventeen lectures (eleven scientific, four literary, and two musical), of a first-class character, have been delivered. To those gentlemen who have favoured the Society with gratuitous lectures, the committee beg to express their best thanks, among whom may be mentioned the Rev. J. Barlow, for his instructive lecture "On a Few Facts and their Scientific Applications." Also to Mr. Williams, for his lecture "On Music." At the commencement of last winter it was proposed that classes for the study of various subjects should be established, but unfortunately the members did not second the committee in their undertaking. The local music class, however, still meets with the support of a large number of members, whose progress in music fully testifies to the ability of the instructor. In the early part of January last the committee held an Evening Festival. A tea was provided, of which one thousand persons partook, after which Mr. Williams, assisted by a large number of his pupils, entertained the company with a selection of vocal and instrumental music.

Woburn.—In presenting the eighth annual report of the Literary, Scientific, and Mechanics' Institution, the Committee have still to regret the great fluctuations in the number of members from one quarter to another.

The number of members for the first quarter of the past year was 97, for the second 66, for the third 50, whilst the number for the fourth quarter again rose to 90. The receipts from all sources during the year have amounted to £28 7s. 11d. The ordinary expenditure has been £26 14s. 4d., leaving a balance of £1 13s. 7d. But £7 15s. 9d. has been paid during the year for apparatus, purchased in compliance with a resolution passed in 1853. At a meeting of the Committee in November, 1853, which was attended by several of the vice-presidents, £35 out of the exhibition surplus was ordered to be reserved for the purchase of philosophical apparatus—but the total sum expended for this purpose has been £15 6s. 1d., of which the before-named sum of £7 15s. 9d. forms part. Only two lectures have been given during the year. The very small number of the members who attend lectures has made the Committee reluctant to ask gentlemen to come from a distance, and has also deterred members of the Institution from devoting time and incurring expense in preparing lectures. Several entertainments have been given by strangers during the year, to which members of the Institution have been admitted at reduced charges. A concert was given in aid of the funds of the Institution, by the members of the Harmonic Society in October last, the profits of which amounted to £1 7s. 8d., although all members were admitted free. A course of lectures on natural philosophy was commenced in January, 1857, and continued during the spring months. Classes for writing and arithmetic are being carried on under the superintendence of the librarian. 1,240 volumes of books have been taken out to read during the year, exclusive of the unbound periodicals. The Committee have attempted to carry out a suggestion made at the last annual meeting, viz., to supply the villages in the neighbourhood with books for circulation at a low rate of membership. Ridgmount has been selected for the first experiment; the subscription has been fixed at one shilling per quarter, and the number of books allowed at a time is in proportion to the number of members. The books are exchanged as often as required. It will be one of the duties of the new committee to decide whether any attempt shall be made to carry the experiment further.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
Entomological, 8.

Tues. ......Royal Inst., 3. Mr. J. P. Lacaita, "On the History of Italy during the Middle Ages."
Syro-Egyptian, 7½. Mr. J. Bonomi, "On the Description of the Sarcophagus of Oseirisi in the Museum of Hartwell."
Med. and Chirurg., 8½.
Zoological, 9.

Wed. ......Literary Fund, 3.
Royal Soc. Lit., 4½.
Geological, 8.
Archæological, 8½.

Thurs. ...Royal Society Club, 6.
Antiquaries, 8.
Royal, 8½.

Fri. ....United Service Inst., 3. Rev. G. R. Gleig, "On the Duke of Wellington's Wars in India, and the Views which he entertained of what ought to be the Military and Civil System of English Administration in that Country."
Astronomical, 8.
Royal Inst., 8½. Prof. Faraday, "On Mr. Wheatstone's Electric Telegraph."

Sat. ....Royal Inst., 3. Dr. Lankester, "On the Vegetable Kingdom in its relations to the life of man."

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 22nd, 27th, and 28th May, 1858.

192. Education (Consolidation of Minutes and Regulations)—Paper.
283. Cumbrae Lighthouse—Return.
284. Navy (Continuous Service Men)—Return.
269. Oxford University—Copies of Regulations.
68 (4). Trade and Navigation Accounts (30th April, 1858).
273. London Corporation Regulation Bill—Minutes of Proceedings of the Select Committee.
279. Coals, Coke, and Culm—Account.
285. Mr. W. P. Snow—Copies of Memorials, &c.
237. Silver, &c. (China)—Return.
275. Examinations (Army)—Copies of Report and Correspondence.
288. Endowed Schools (Ireland)—Return, &c.
293. Ordnance Survey (Scotland)—Return.
88. Bills—Public Health.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 28, 1858.]

Dated 22nd March, 1858.

596. A. Lester, Coventry—Imp. in weaving ribbons, fringes, trimmings, and other narrow fabrics.

Dated 9th April, 1858.

768. J. B. Biebuyck and J. Van Landuyt, Brussels—An improved process for separating the vinous and amylaceous principles from vegetable substances.

Dated 14th April, 1858.

804. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in obtaining motive power, and in apparatus connected therewith. (A com.)

Dated 20th April, 1858.

860. E. Derogy, 33, Quai de l'Horloge, Paris—Imp. in instruments and apparatus applicable to photographic purposes.

Dated 23rd April, 1858.

896. W. Ryder, Bolton le-Moors, Lancashire—Imp. in preparing moulds and moulding boxes for casting metal or other materials.

Dated 24th April, 1858.

904. A. S. Stocker, 18, Wimpole street, Cavendish-square—Imp. appertaining to articles to be affixed to boots and shoes, and to the feet of animals, and in the machinery and means employed for producing the same.

Dated 27th April, 1858.

938. D. E. Hughes, New York, U.S.—Imp. in the means of, and apparatus for, transmitting signals and electric currents.

Dated 3rd May, 1858.

987. W. Clark, 53, Chancery-lane—Imp. in separating and in otherwise treating matters in a state of fusion, and in apparatus for the same. (A com.)

Dated 4th May, 1888.

990. W. H. Morrison, Nottingham—Imp. in means or apparatus employed in the manufacture of bonnet and cap fronts, rouches, and such like articles of millinery.

Dated 5th May, 1858.

994. R. Sharp, Lowther-street, Liverpool—Imp. in pianofortes.
998. T. Preston, Nottingham—Imp. in the manufacture of cut pile fabrics, in warp machines.
1000. J. Lawson and T. Robinson, Leeds—Imp. in machinery for hackling and dressing flax, and other fibrous substances.

Dated 6th May, 1858.

1001. M. Davis, 5, Lyon's-inn—Imp. in carriage wheels, and in means of retarding their motion.
1006. J. Whitley, Leeds—Imp. in the manufacture of iron, which imp. are also applicable when obtaining other metals from their ores.
1008. E. J. Scott, Glasgow—Imp. in the manufacture of boots and shoes.
1010. T. W. Thacker, Derby—Imp. in the construction of the finger-ends of pianoforte, organ, and harmonium keys.
1012. J. Casey and J. Hughes, Spital-square—Imp. in looms for weaving velvet ribbons.
1014. W. Clark, 53, Chancery-lane—Imp. in "bits" for horses' bridles. (A com.)
1016. H. Jackson, 2, Park-street, Leeds—Imp. in machinery for dressing and cleaning flax, hemp, and other fibrous substances requiring like treatment.

Dated 7th May, 1858.

1018. J. Bunnett and J. G. Bunnett, Deptford—Imp. in steam-engines.
1020. J. Castle, Grantham—Certain imp. in breaks used for retarding the motion of carriages on ordinary roads.
1024. J. J. Field, Paddington—Imp. in evaporating or in extracting moisture from liquids, and from substances in a liquid state, and in apparatus to be employed therein.
1026. W. E. Newton, 66, Chancery-lane—Imp. in the construction of fire-grates for furnaces, stoves, and other fire places. (A com.)
1028. C. Botten, junr., Clerkenwell, and N. F. Taylor, Stratford—Imp. in means or apparatus employed in measuring and in regulating the flow of gas and other fluids.
1030. T. Brown, Ebbw Vale, and D. Brown, Cwmbran, Monmouthshire—New or improved machinery for filing or smoothing the ends of fish-plates, rails, wrought iron railway chairs, and other articles made by sawing bars transversely.
1032. W. Clark, 53, Chancery-lane—Imp. in apparatus for sharpening saws. (A com.)

Dated 8th May, 1858.

1033. J. T. Robson, 45, Hugh-street, West Pimlico—Imp. in sheet flue and tubular boilers. (A com.)

1034. A. V. Newton, 66, Chancery-lane—Imp. in machinery for manufacturing paper. (A com.)
1035. W. E. Newton, 66, Chancery-lane—Certain imp. in grinding circular saws. (A com.)
1037. G. Day, St. Pancras—An improved self-acting valve for regulating the flow of liquids.

Dated 10th May, 1858.

1039. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the manufacture of umbrellas and parasols. (A com.)
1041. W. H. Ogden, Liverpool—Imp. in pumps.
1042. W. C. Forster, 6, Great Tower-street—An imp. in the manufacture of bricks and slabs for preventing damp in the walls of houses and other buildings.
1043. I. L. Bell, Washington Chemical Works, Newcastle-upon-Tyne—Imp. in the manufacture of iron.
1044. J. M. E. Masson, Rue des Fossés St. Thomas, at Evreux (Eure), France—Imp. in diving apparatus.
1045. R. Willan and D. Mills, Blackburn—Imp. in machinery or apparatus for drawing in, twisting, or looming textile materials.
1046. W. G. Taylor, Ashby-de-la-Zouch, Leicestershire—Imp. in covering the rollers employed in spinning cotton and other fibrous materials.
1047. J. B. Pim, Newington Butts, and C. Payne, Bermondsey-street, Southwark—Imp. in recovering useful matters from oil or floor cloth, tarpaulin, American leather cloth, and other like substances.

Dated 11th May, 1858.

1048. P. Apparuti, Paris, Rue Constantine, 24—A machine applicable for picking and choosing out corn.
1049. J. Luis, 1B, Welbeck-street, Cavendish-square—A mechanical washing apparatus for iron ore and other matters. (A com.)
1050. G. H. Creswell, Devonport—Imp. in pads and apparatus for inking stamps.
1051. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in madder dyeing. (A com.)
1052. E. Fairburn, Kirklees Mills, Mirfield, Yorkshire—Imp. in machinery or apparatus employed in carding wool and other fibrous substances.
1053. J. Soutter, Hoxton—Imp. in washing machines.
1054. W. Pare, Seville Ironworks, Dublin—Imp. in metallic and other bedsteads, and other articles of furniture.
1055. A. Parkes, Birmingham—Imp. in the manufacture of tubes and cylinders.
1056. A. Parkes, Birmingham—Imp. in rollers or cylinders used for printing and embossing.
1057. W. Oliver, Cradley, Worcestershire—Imp. in combining ovens for the manufacture of coke with the furnaces of steam boilers.
1058. R. Halliwell, Bolton-le-Moors, Lancashire—Certain imp. in mules for spinning and doubling cotton and other fibrous materials.
1059. G. Lowry, Salford—Certain imp. in machinery for heckling flax and other fibrous materials.
1060. J. M. Gilbert, Manchester—Imp. in the construction of cylinders and maundrils used in printing calico and other surfaces.
1061. J. Dyson, E. W. Shirt, and H. Shirt, Sheffield—Imp. in the mode of rolling strips of steel for crinoline and other purposes.

Dated 12th May, 1858.

1063. L. Durand, Marseilles—An imp. tubular steam generator.
1064. M. Diosy, 123, Fenchurch street—Imp. in machinery for preparing or manufacturing granulated potatoes for preservation. (A com.)
1065. J. A. Détroyat, 10, Rue de Choiseul, and F. Teubert, 18, Rue de Choiseul, Paris—Imp. in apparatus for cleansing hair combs, and other similar articles.
1066. J. A. Clarke, Liverpool—Imp. in composition for coating vessels' bottoms.
1067. W. Mark, Stockton-on-Tees, Durham—Imp. in roofing and other tiles.
1068. J. West, 234, Shales Moor, Sheffield—A mode of covering and securing watertaps and branches.
1069. A. H. Rogers, Fairfield, Manchester—Imp. in lubricators.
1070. J. Sharples, Crawshaw Booth, near Rawtenstall—Imp. in extracting moisture from and drying porous and fibrous substances.
1071. R. Knight, Foster-lane, Cheapside—Imp. in apparatus for refrigerating, also for bottling aerated liquids, and in the preparation or storing salts for the production of artificial mineral waters.
1072. J. G. Jackson, Belper, Derby—A method of carrying roads over (or through) land covered with water.
1073. J. Biggs, Norton Folgate—Imp. apparatus for compressing vegetable and other substances.
1074. A. L. Liétout, Paris—Improved portable medical and hygienic gymnastic apparatus.
1075. J. S. Bailey, and W. H. Bailey, Keighley, Yorkshire—Imp. in machinery for preparing and combing wool, cotton, and other fibrous materials.
1076. J. Hamilton, Belfast—Imp. in the preparation and use of starch for manufacturing, bleaching, and finishing purposes.

Dated 13th May, 1858.

1077. W. Simons, Glasgow—Imp. in the construction of iron ships or vessels.
1078. R. Hislop, junr., Preston Pans, Haddington, N.B.—Imp. in machinery or apparatus for dressing or cleansing and separating grain and seeds.
1079. A. M. Dix, Hanley, Staffordshire—Certain imp. in the process of brewing or obtaining dedoctions, and in apparatus connected therewith, which apparatus is also applicable to condensing, refrigerating, or other such like purposes.
1080. F. A. Deliry, Soissons, France—An improved mechanical kneading trough.
1081. A. Wolff, Paris—Imp. in musical instruments.
1082. H. Hyde, Truro, Nova Scotia—An improved mode of, and improved apparatus for, manufacturing oils. (A com.)
1083. J. Gardner, Banbury—An imp. in chaff-cutting machines.

Dated 14th May, 1858.

1084. F. Warren, Birmingham—Imp. in the construction of stands for telescopes and other instruments.
1085. J. Colgate, 56, Exmouth street—A "pipe case handle" for walking sticks, canes, riding whips, and umbrellas.
1086. S. Carpenter, Flushing, U.S.—Imp. in escapements for watches and other time keepers.
1087. D. Dick, 55, George-street, Paisley—Improved cushions for trusses and other similar uses.
1088. W. E. Newton, 66, Chancery-lane—Imp. in the construction of lamps. (A com.)
1089. G. F. Chantrell, Liverpool—An improved waterproof lithic paint.
1091. L. Petre, Hatton-garden—Imp. in the application of glass to ornamental and useful purposes.

Dated 17th May, 1858.

1092. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in the construction of artificial legs and feet. (A com.)
1094. J. Allen and W. Allen, Wallsend, Northumberland—Imp. in the treatment of iron and copper pyrites, and in apparatus for same.
1096. J. Wittenberg, Cambridge-villas, Notting-hill—Imp. in motive power engines actuated by air.
1098. W. Raymond, Dalston—Imp. in life rafts.
1100. S. Hiler, Havestraw, U.S.—An improved method of coating or amalgamating iron with silver, copper, brass, or other metals, or alloys of metals.
1102. S. Higgs, junr., Penzance—An imp. in separating or precipitating copper from water having it in solution.

Dated 18th May, 1858.

1104. W. J. Hixon, 8, Victoria-grove-terrace, Bayswater—Imp. in the construction of reaping and mowing machines, and in the form or shape of the knife or knives to be used in connection therewith.
1106. J. Mallison, jun., Bolton-le-Moors—Imp. in the process of and in the machinery or apparatus for dyeing yarns.
1108. E. C. Brochand, Gerrard-street—A travelling mill and improved millstones, part of the invention being applicable to other apparatus turned or worked by horses.

WEEKLY LIST OF PATENTS SEALED.

May 28th.

2972. T. Kaye.
2985. D. Lane.
2989. J. Eccles.
2991. W. Bird, R. Ashton, and T. Bird.
3036. C. Nightingale.
3058. W. Denne.
3163. H. C. F. Wilson & T. Green.
3183. E. Gomez and W. Mills.
236. E. Reader and J. Dewick.
384. W. Chadwick.
444. J. N. Hearder.
587. W. E. Newton.
606. C. Clifford.
690. R. Peter.
749. E. Foster.
752. S. O. Mason.
753. E. Richmond.

June 1st.

2986. T. J. Thompson.
2998. L. F. E. Ciceri.
3003. C. Henwood.
3004. W. Parsons and J. Attree.
3021. J. Brinton and J. Crabtree.
383. W. C. Smith.
641. J. Horton.
679. F. A. Gatty.

Patents on which the Stamp Duty of £50 has been Paid.

May 26th.

1191. F. H. Maberly.
1203. J. Avery.
1230. G. Rogers.

May 27th.

1263. H. Cartwright.

May 28th.

1231. W. A. Henry.
1243. C. T. Dunlop.
1287. A. Morton and E. Hunt.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4093	June 2.	A Furnace for Smelting and Refining Iron.	J. Clayton	Wolverhampton.

Journal of the Society of Arts.

FRIDAY, JUNE 11, 1858.

SEVENTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Seventh Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on Thursday, the 24th of June, at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference, as matters connected with the arrangements for the next year's Examinations will, amongst other subjects, be brought under consideration.

ANNUAL DINNER.

The One hundred and fourth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Thursday, the 24th instant, at half past five for six o'clock punctually. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Wednesday next, the 16th instant.

CONVERSAZIONE AT SOUTH KENSINGTON.

The following letter has been addressed by the Council of the Society of Arts to the Lords of the Committee of Council on Education :—

Society of Arts, Manufactures, and Commerce,
Adelphi, London, W.C., June 9th, 1858.

My Lords,—I am directed by the Council of the Society of Arts to thank your Lordships for the advantage which the Society enjoyed in holding its Conversazione, by your permission, in the Museum at South Kensington, on Saturday, the 8th ult.

The Conversazione was attended by more than 2,280 persons, principally members of the Society and of Institutions in union with it.

The requisite arrangements were skilfully made by your officers; the whole of the building was opened to the visitors; and the collections, which were examined with much interest, were generally and very highly appreciated.

In making this communication to your Lordships, the Council cannot confine themselves to an expression of thanks for the advantages which the Society enjoyed on the particular occasion referred to. The Council avail themselves of this opportunity to record how highly, on public grounds, and in the interests of "Arts, Manufactures, and Commerce," the Society appreciates the wise liberality which has characterised the regulations laid down by the Committee of Council in respect of the public uses of the Museum at South Kensington.

It is open, on certain evenings of each week, to the general public, free of charge; and on certain other evenings of each week it may be visited by Societies which promote Art, Science, or Education.

The creation and maintenance of museums and similar establishments, at the expense of the public, can only be justified when they are open as fully and freely as possible to the use of the public; and there are large masses of persons, quite capable of profiting by visits to museums, who are practically debarred from using them if they are closed during the evening. Your Lordships are aware that immense numbers of persons have used the privilege of visiting the Museum at South Kensington of an evening, and the Council of the Society of Arts cannot but express its earnest hope that the success of the great experiment which your Lordships have tried, may lead to the adoption of the same wise liberality in other departments.

I have the honour to be, my Lords,
Your Lordships' most obedient servant,
P. LE NEVE FOSTER, Secretary.

BRITISH HONDURAS.

The following communication has been received from the Honourable R. Temple, Chief Justice of British Honduras :—

As the importance of British Honduras becomes more recognised—as, in a commercial point of view, its value becomes more appreciated, the more desirable is it that all doubts as to its being a dominion of the British Crown should be removed. There has been much misapprehension upon this subject, owing to an ignorance of many of its real features. All the disputes which have arisen with our Transatlantic friends, within the last six or seven years, respecting our tenure of Honduras, have been grounded upon the assumption, on the part of the American writers and statesmen, that the treaties of 1783 and 1786, between Great Britain and Spain, remained unrescinded, although neglected, but were like some law which for a number of years had fallen into desuetude, but which might at any time be drawn from its dark and dusty corner, and, like the dry bones of the Prophet's vision, be made to assume its original vitality and vigour. Upon this assumption the argument, on the American side, has hitherto been based. I trust that I shall be able to prove very satisfactorily that nothing can be more erroneous than such a supposition.

I wish to speak with the greatest respect of the United States as a nation. I wish most carefully to avoid using a single expression calculated to cause any angry feelings in the minds of the energetic, enterprising, courageous, intellectual, but somewhat irritable people of that country, but I cannot refrain from charging them with a meddling disposition and an arrogant spirit, in presuming to dictate to the British Government as to what are and what are not the rights of the British Crown with respect to territories to which they themselves cannot have the slightest pretensions. What is it to them whether we have or have not any territorial rights in British Honduras? That is a question to be discussed, if discussed at all, with Spain, and not with the United States. Even assuming it to be a fact (and it is very far from being so) that Mexico and the Central American States succeeded to all the rights which Old Spain formerly possessed, still, the United States could not, with any show of reason, upon this ground, pretend to dispute our sovereignty in Honduras, for the question would then be between Great Britain and those States. As well might the United States dispute our right to Jamaica, or question our claims to New Zealand and Australia. "But (says Mr. Buchanan) Mr. Monroe, when President of the United States, had, in 1823, announced, in a public message to Congress,

that the American continents were not henceforth to be considered subject to colonization by European Powers." Who constituted Mr. Monroe the lawgiver of nations,—the Lycurgus of the world? What does it signify to us what doctrine Mr. Monroe chose to lay down in his presidential address to Congress? Other countries were not bound by it. Suppose Mr. Monroe had added, "Neither shall the islands in the Caribean Sea be subject any longer to European sway. Cuba shall be released from the yoke of Spain, and Great Britain shall be relieved from the burthen of governing Trinidad and Jamaica." Such language would certainly be very ridiculous, but it would be in accordance with the principle of his doctrine. If the President of the United States is empowered to lay down, when addressing Congress, territorial doctrines unknown to Vattel, unmentioned by Grotius, the same liberty cannot be denied to the Queen of Great Britain, and she might with equal propriety lay down the rule in her next speech to Parliament that the United States shall not be permitted to trade with China, shall not be allowed to have any commercial intercourse with India, that Japan shall be a sealed book, and the Phillippine Islands forbidden ground. Such a determination on the part of our Most Gracious Queen, addressed to the British Parliament, would be quite as rational as that which was announced by Mr. Monroe to the American Congress.

But notwithstanding this arrogant annunciation, which was quoted by Mr. Buchanan for the purpose of inducing the British Government to abandon the territories of the crown in the Bay of Honduras, it is satisfactory to observe that it received no craven and pusillanimous response from the power to which it was addressed. Lord Clarendon, with that dignified firmness which belongs to him, in his letter to Mr. Crampton, dated May 27th, 1853, says:—"But Great Britain has nowhere in the treaty of April, 1850, renounced, nor ever had any intention to renounce, the full and absolute right which she possesses over her own lawful territories in Central America."

Mr. Buchanan says, "It would be a vain labour to trace the history of the connection of Great Britain with the Mosquito shore and other portions of Central America, previous to her treaties with Spain of 1783 and 1786." This is a mistake. There is no difficulty whatever in tracing the occupations of the British in the Bay of Honduras to their origin, and this I will now proceed to do. But I would first rectify an error which all American politicians and diplomatists commit, when speaking and writing on this subject. They represent British Honduras as being in Central America. It is no such thing. Previously to the revolt of the several States which now come under that denomination, the term "Central America" was unknown. The whole of the country which is now split into the petty States of Guatemala, Honduras, San Salvador, and Costa Rica, was called the Kingdom of Guatemala, which stretched as far in a northerly direction as the Hondo, and some writers assert, and those Americans, that it went even beyond that river. It comprised Vera Paz and Chiopas. But in 1821 the whole of the country between the Sarstoon and the Hondo had been for many years in the undisputed and peaceable possession of the English, and had long ceased to be considered as a portion of Guatemala. The term Central America, therefore, being applied only to the states which at that time asserted their independence, excluding Guatemala as it then existed, and so much of it as was under the dominion of Spain,—British Honduras cannot with propriety be said to be a part of it.

It can be clearly proved that during the Commonwealth, in the year 1653, the English logwood cutters had succeeded in firmly establishing themselves in the whole of the country between the Siban and the Hondo, and had also occupied all the islands in the Bay of Honduras, including what are now called the Bay Islands. That they had many a hard tussle for these possessions with the few inhabitants who were scattered over the uncleared tracts between the limits above mentioned, and that much unjustifiable violence, and many deeds of rapine and savage cruelty were committed, there is little doubt; but that they succeeded in firmly planting themselves on the soil there is as little. The Spaniards made many ineffectual attempts to remove them. But the Spaniards, in the reign of Phillip IV. were not like those in the time of Charles I. They were not like those indomitable spirits who followed Cortez and Pizarro through difficulties and dangers, and performed feats of daring, the narrative of which is more like the romantic account of the wondrous deeds of Orlando, the heroic actions of Godfrey, and the valorous achievements of the Cid, than authentic history. They differed as much from them as the effeminate Romans of the latter days of the Empire, who became the easy spoil of the wild hordes of Attila and Alaric, differed from the invincible cohorts of Scipio, or the impregnable legions of Cæsar,—or the dastardly Greeks of the present day from those who fought at Salamis and Platæa. It is an old saying, "What cannot be cured must be endured." Whether Charles II., the successor of Phillip, had ever heard this apothegm, I cannot say, but he certainly acted in the spirit of it, for in the year 1760 he concluded a treaty with Great Britain, the 7th article of which is as follows:—

"All offences, damages, losses, injuries, which the nations and the people of Great Britain and Spain have at any time heretofore, upon any cause or pretext whatsoever, suffered by each other in America, shall be expunged out of remembrance, and buried in oblivion, as if no such thing had ever passed.

"Moreover, it is agreed that the Most Serene King of Great Britain, his heirs and successors, shall have, hold, keep, and enjoy for ever, with plenary right of sovereignty, dominion, possession, and propriety, all those lands, regions, islands, colonies, and places whatsoever, being, or situated in, the West Indies, or in any part of America, which the said King of Great Britain and his subjects do at present hold and possess, so as that in regard thereof, or upon any colour or pretence whatsoever, nothing more may, or ought to be urged, nor any question or controversy be even moved, concerning the same hereafter."

Had this treaty been undisturbed, I presume no question could ever have arisen respecting our right to British Honduras, the Bay Islands, and the Mosquito shore. But in 1783 and 1786, Mr. Pitt being First Lord of the Treasury in the latter year, with a most short-sighted policy we agreed to treaties which extinguished our sovereignty over territories which had been solemnly sanctioned by the crown of Spain.

In a long statement made by Mr. Buchanan, in reply to Lord Clarendon, dated July 22, 1854, the following observations are contained:—

"The British statement claims the territory between the Siban and the Sarstoon by right of conquest, and observes, that the treaty of 1786 was put an end to by a subsequent state of war with Spain, and during that war the boundaries of the British settlement in question were enlarged; and that the subsequent treaty of peace not having revived the treaties of 1783 and 1786, Great Britain is entitled to retain this territory.

"It may be observed that the statement does not mention at what period the boundaries of the British settlements were enlarged. If this took place, as it is believed it did, after the date of the treaty of alliance between Great Britain and Spain in 1809, which terminated the war, then this argument falls to the ground. If before 1809, Great Britain, when concluding this treaty, ought to have informed Spain that she intended to convert the encroachments of the settlers in Belize on Spanish territory into an absolute right. That she did not then intend to pursue such a course towards an ally in distress, is clear from her subsequent conduct.

"In 1814, Great Britain revived all her pre-existing

commercial treaties with Spain; and what is the privilege granted to her by the treaty of 1786, of cutting mahogany, logwood, and other dyewoods on Spanish territory, thus enabling her to extend British commerce in those articles, but a commercial privilege?

"So far from the treaty of 1786 being put an end to by the war, its continued existence in 1817 and 1819 was recognised by the Acts of the British Parliament. These declare, in so many words, that 'Belize was not within the territory and dominion of his Majesty,' but was merely 'a settlement for certain purposes, in the possession and under the protection of his Majesty.'

"For the nature of this 'settlement' and a knowledge of these 'certain purposes,' we can refer nowhere except to the treaties of 1783 and 1786.

"In addition to these Acts of Parliament, it is proper here to report, that so late as 1826 Great Britain has, by her treaty with Mexico, acknowledged the continued existence and binding force of the treaty of 1786."

These arguments against the territorial rights of the British Crown in Honduras I shall now humbly endeavour to answer.

It is freely admitted that, whatever might have been the rights of the British Crown previously to the treaties of 1783 and 1786, under those treaties the subjects of his Britannic Majesty had a qualified occupation of Honduras. The treaties gave to them limited privileges, and were most careful in avoiding any expression which could be construed into a grant of territory. It is most freely admitted there, that under the treaties in question, we can have no claim beyond those privileges, the exercise of which was to be confined within certain specified limits. I have already expressed my surprise and regret that the government should have been so impolitic and shortsighted, considering the vantage ground which they held, as to have agreed to those treaties, but of this I am convinced, that however wrong they might have been, as regarded the interests of Great Britain in the course which they adopted, they acted with perfect good faith towards Spain. It is more than doubtful whether Spain acted in a similar spirit towards Great Britain; but, let the intentions of the former power have been what they might, this fact is certain,—we strictly observed the provisions of the treaties. Spain did not. One of the stipulations of the treaty of 1786 was, that the English should evacuate the Mosquito shore. They did evacuate it. One article prohibited the building of any fort. No fortification of any sort was constructed. Another forbade the cultivation of the soil for the purpose of exporting its produce. No cultivation was attempted. Another confined all wood-cutting operations between the Hondo and the Siban. Beyond those rivers the cutters did not go. In short, there was not a single particle of the treaties which the English settlers did not religiously observe. And how did the subjects of His Most Catholic Majesty conduct themselves in reference to them? It is a notorious fact, that the English were constantly liable to the attacks of the Spaniards, who sought every opportunity to disturb them in their peaceful occupations, in the hope that, harassed, worn, vexed, tired out, they might be induced to abandon a country where they had no quiet, where they could not sleep in safety, where they must constantly have their loins girded, and where the fruits of their labour were every hour liable to be stolen or destroyed. In the year 1798, the Spaniards, headed by General O'Neill, the Captain-General of Yucatan, made a grand attack upon the British, but were repulsed with great loss. Notwithstanding that war was declared between Great Britain and Spain in 1796, the settlers did not take advantage of that circumstance to improve their condition, but continued peaceably to follow their cutting operations, and faithfully to observe the treaties. But after the "affair" of '98, there was an end of all treaties—and it was high time. Now, it is a maxim of international law, of universal acceptation, and I think that our American friends will not repudiate it, that a declaration of war between two countries operates at once as an entire abrogation of all treaties previously existing between them, and that those treaties do not necessarily start again into existence when the war ceases, as naturally as Castor rises when Pollux sets, but that they must be, if it be deemed advisable, specially revived by an express treaty to that effect. In 1783, the Spanish Crown, by a treaty signed at Versailles, granted to the subjects of the King of Great Britain the right to cut logwood in Honduras, under certain restrictions and within particular limits. The convention between Great Britain and Spain, signed in London in 1786, extended those limits, and gave permission to British settlers to cut mahogany as well as logwood. In 1796, war was declared between Great Britain and Spain, and the treaties of 1783 and 1786 were thereby abrogated and annulled. The Spanish Government acted upon this principle, and were perfectly right in so doing. But the subjects of Spain—whether at the suggestion of their government or not I am not prepared to say—had never acted with good faith in respect to the treaties; they had constantly carried on a guerilla war against the subjects of his Britannic Majesty. Now, however, that the treaties had ceased to exist, and they were not bound by any *political* obligation to respect the persons and property of the English, they were quite justified in compelling them to evacuate the country, if they were able to do so. The Spanish Government, therefore, gave orders to General O'Neill, the Captain-General of Yucatan, to dispossess the English of the lands which they held under the treaties, and drive them out of the country. This officer, as I have before stated, made a vigorous attempt to carry the orders of his government into execution, but he met with a determined and successful resistance, and the British settlers maintained possession of the country which they had previously held, subject to the restrictive provisions of the treaties. But they not only maintained possession of the country, they ceased to regard that possession as a permissive one, and treated it as an absolute possession, founded upon the complete, unqualified ownership of the soil. But this was not all. Considering, as they were justified in doing, that all treaties between Great Britain and Spain were abrogated by the war, and more especially those affecting themselves, which the Spaniards, never faithfully observing, had been the first, by their attack under O'Neill, to declare void, and perceiving that the whole of the country to the south of the Siban (the boundary line of the Convention of 1786) as far as the Sarstoon, was vacant and unoccupied, they took possession of that part which was densely covered with the primæval forest, on which there was not a single habitation, where, perhaps, human foot had never trod before, and where the scream of the vulture, the howl of the jaguar, and the roar of the cataract as it rushed down the mountain steeps, were the only sounds which fell upon the ear. Since that period, the occupation, which then commenced, until the present day, has been continuous. It has never ceased for one moment, and it has never been once disturbed, protested against, or questioned by Spain. At the conclusion of the war between Great Britain and Spain, the treaties of 1783 and 1786 were not revived, nor were they brought into existence at any subsequent period. On the cessation of hostilities, a treaty was concluded between Great Britain and Spain, which was signed in London on the 14th of January, 1809. In this short treaty, which consists of only two articles, no mention whatever is made of the treaties of 1783 and 1786, nor, indeed, of any other treaties; but by an additional article signed in London on the 21st of March, in the same year, the two countries mutually agree to proceed to a regular negotiation of a treaty of commerce as soon as it shall be practicable so to do, affording in the meantime mutual facilities to the commerce of the subjects of each other, by temporary regulations founded on principles of reci-

procal utility. On the 5th of June, 1814, a treaty of commerce was concluded between Great Britain and Spain, in which no mention is made of the defunct treaties of 1783 and 1786. On the 24th of August, 1814, additional articles were signed at Madrid. The first article is as follows:—

"It is agreed that, pending the negotiations of a new treaty of commerce, Great Britain shall be admitted to trade with Spain upon the same conditions as those which existed previously to the year 1796, [or before the war broke out], all the treaties of commerce which at that period subsisted between the two nations being duly ratified and confirmed."

From the terms of this article it has been hastily and illegally concluded that the treaties of 1783 and 1786 were revived, but upon a careful consideration of the words, and an examination of the strict meaning of those words, it will, I think, be admitted that they will not bear that construction:—

"It is agreed that Great Britain shall be admitted to trade with Spain upon the same conditions as those which existed previously to the year 1796." Was it necessary to revive the two treaties of 1783 and 1786 to enable Great Britain to do that? Assuredly not; there is not one word in those treaties relating to the trade between Great Britain and Spain, and if there had been, only so much of the treaties would have been revived as stated the "conditions" of that trade. If then we were allowed to trade with Spain "upon the same conditions" as those which existed before the war, it was useless going to those treaties to ascertain the conditions, because they are not there stated, and only those treaties were revived which did state the conditions. No one who has read Whateley or Watts could come to any other conclusion. But the logic of those who draw a different inference is somewhat akin to that of the young gentleman who offered to prove to his astonished guardian that "an eel-pie was a pigeon." Neither does the article above quoted mention by name, or in the most distant manner allude to, the treaties in question. Vattel says, "As every power at war pretends to have right on its side, and this pretension is not liable to be judged by others, the state of things at the instant of the treaty is to be held legitimate, and any change to be made in it requires an express specification in the treaty, consequently all things not mentioned in the treaty are to remain as they were at the conclusion of the war." And again, "Preceding treaties, mentioned and confirmed in the last, make a part of it." Now, in the convention of 1814 no mention whatever is made of the treaties of 1783 and 1786. But the article above quoted says, "All the treaties of commerce which at that period subsisted between the two nations, being hereby certified and confirmed." Now, if the treaties of 1783 and 1786 were treaties of commerce, they are revived by those words. What is a treaty of commerce? It is an agreement, or contract, entered into between two countries, by which the subjects of each are to be permitted to trade with each other in those countries, or their dependencies, they being allowed to have reciprocal advantages. It differs from a political treaty, which is a contract, not relating to mutual trade and commerce, but to territorial limits and boundaries, or the acts and deeds which the governments themselves may or may not perform; and from a treaty defensive and offensive, which is a treaty of alliance, by which each country engages to assist the other with arms, if war should break out between either of them and some other power. It may be general, or it may have reference only to a particular war. Now, I assert that the treaties of 1783 and 1786 were not treaties of commerce. Not one word is mentioned in either of them respecting the mutual trade and commercial relations of the two countries. The revival of them would not have enabled Great Britain to trade with Spain, more than she could have done without them; and over our commercial transactions with that country, since the convention of 1814, they have not exercised the slightest influence. But Mr. Buchanan contends that they are treaties of commerce, because, says he, "what is the privilege granted to her by the treaty of 1786, of cutting mahogany, logwood, and other dyewoods on the Spanish territory, thus enabling her to extend British commerce in these articles, but a commercial privilege?" This argument belongs to the class of those which prove that an eel-pie is a pigeon, that a cat has three tails, and the like absurdities. One country by a treaty grants to the subjects of another country the use of a certain territory, by which use the grantees are enabled to carry on a particular kind of trade, not with the subjects of the granter, but with their fellow-subjects, *ergo*, that treaty is a treaty of commerce. So, if I leave to Mr. Buchanan for a term of years certain tan pits, by the use of which he is able to pursue his trade, and supply his customers with leather, I, by that leave, enter into a contract of trade with him. Nothing can be more ridiculous. A treaty of commerce is not a treaty granting certain privileges, by which the grantees are enabled to carry on a particular trade, but it is a treaty between two countries, by means of which the subjects of those countries may trade with each other in the articles peculiar to each country, in which commercial intercourse they receive facilities and advantages denied to the subjects of other countries not being parties to the treaty. That is a treaty of commerce. Neither the treaty of 1783 nor that of 1786 was such a treaty.

They are not styled Treaties of Commerce. That of 1783 is called "A Definitive Treaty between Great Britain and Spain," and that of 1786 "A Convention between Great Britain and Spain." The difference between a treaty and a convention I take to be this. A treaty is general and permanent, or intended to continue for a lengthened period. A convention relates to some particular object, or it is temporary, or provisional. The treaty of 1783 was a "treaty of peace," not a treaty of peace and commerce. But the one great and leading object of the treaty is made sufficiently manifest by the sixth article, which commences as follows:—

"The intention of the two high contracting parties being to prevent, as much as possible, all the causes of complaint and misunderstanding heretofore occasioned by the cutting of wood for dyeing, or logwood, and several English settlements having been formed and extended under that pretence upon the Spanish continent, it is expressly agreed that his Britannic Majesty's subjects shall have the right of cutting, loading, &c."

One great object of this treaty, then—which, no doubt, was a general treaty of peace—is obvious. The English had formed settlements upon the Spanish continent, in consequence of which disputes had arisen between them and the subjects of the crown of Spain, but, "to prevent, as much as possible, all causes of complaint and misunderstanding," the crown of Spain gives permission to the English to cut logwood within certain limits, and under certain restrictions. This, then, was the principal object of the treaty, not to enable the subjects of his Britannic Majesty to trade with the subjects of the Crown of Spain, but to prevent, by confining the British within certain limits, where they might be at liberty to cut logwood, "all causes of complaint and misunderstanding." Can this treaty, then, be correctly called a treaty of commerce? It is not stated that there was to be any trade with Spain. The logwood, when cut, was shipped to England, and there is no provision whatever that there should be any commercial intercourse of any kind between the subjects of the two crowns. On the contrary, the intention of the treaty seems to have been that all intercourse should cease, and, "to prevent complaints and misunderstandings," each should be confined within its own limits. Indeed, a little reflection will convince anyone that a treaty of commerce between the two nations would have been, under the circumstances, an

absurdity. When a treaty of commerce is agreed upon between two countries, it is supposed that each country produces articles which the other country does not produce, but which it requires. For instance, by the treaty between Great Britain and Portugal, in 1703, commonly called the "Treaty of Methuen," because it was negotiated by John Methuen, the British Ambassador Extraordinary in Portugal, it was agreed that the woollen manufactures of Great Britain should be admitted into Portugal as had been formerly accustomed, upon condition that wines of the growth of Portugal should be admitted into Great Britain on payment of two-thirds of the duty which was demanded for French wines. Ever since that period the English people have been poisoned by potations of heady Port, instead of being invigorated and enlivened by wholesome draughts of Bordeaux and Burgundy.

This was a treaty of commerce, and it is intelligible. But suppose a company of Englishmen were to settle in Portugal, and, like Noah, of blessed memory, plant vineyards, where would be the use of a treaty of commerce between them and the Portuguese?—they could only get Port in exchange for Port. In like manner, of what use was a treaty of commerce between the British settlers in Honduras and the Spaniards?—the former could only have supplied the latter with logwood, and of that article they had more than sufficient. Besides logwood, the only article in which the settlers dealt, would have been of no use to the Spaniards, because they had no manufacturers requiring the use of that dye. England was the only country at that time which made use of logwood, and England, therefore, was the only country which supplied a market to the cutters.

The treaty of 1783, then, was clearly not a treaty of commerce. Was that of 1786? This treaty is, in principle, the same as the former one. It extends the limits, and it grants permission to cut mahogany as well as logwood. It also stipulates for the performance of certain conditions, such as the evacuation of the Mosquito country, and the abstaining from erecting fortifications. But there is not a single word about trade, nor is there one expression from which we may gather that it was the intention of the contracting parties that the subjects of the two crowns should have any commercial intercourse with each other. But the 9th article of the treaty of 1783 affords the most convincing proof that that treaty was not considered—not intended to be —a treaty of commerce. It is as follows:—"Immediately after the exchange of the ratifications, the two high contracting parties shall name commissioners to treat concerning new arrangements of commerce between the two nations, on the basis of reciprocity and mutual commerce, which arrangements shall be settled and concluded within the space of two years, to be computed from the 1st of January, 1784."

From this article nothing can be clearer than that the treaty of 1783 was not itself considered, nor intended to be, a treaty of commerce, inasmuch as it agrees that commercial arrangements shall be entered into within the space of two years after the 1st of January, 1784. The commercial arrangements were *in futuro*, there were none *in præsenti*.

The treaties of 1783 and 1786, then, were not treaties of commerce, and the convention of 1814, which confirmed all the treaties of commerce which had subsisted before the war, could not confirm them under that denomination. Did that Convention, then, confirm them specially? The definitive treaty of 1783 confirms a number of treaties, but it confirms by name, as the treaty of Westphalia, of Madrid, of Utrecht, of Baden, of Seville, of Aix-la-Chapelle, &c. The convention of 1814 never mentions nor alludes to them, and we have seen that, according to Vattel, "all things not mentioned in the treaty are to remain as they were at the conclusion of the war." Is there any other treaty which, it is pretended, revived those of 1783 and 1786? No! The convention of 1814 is the only one which has been supposed to have exercised that resuscitating power.

Mr. Buchanan, in his statement to the Earl of Clarendon, dated January 6th, 1854, admits that the treaties of 1783 and 1786 were abrogated by the war, and that they had no existence, unless they had been revived by some subsequent treaty. He says:—"At what period, then, did Great Britain re-open her claims to the country of the Mosquitos, as well as to the continent in general? * * * * It certainly was not in 1814, when the commercial treaties which existed between the two powers, including, it is presumed, those of 1783 and 1786, were revived."

Mr. Buchanan admits that those treaties were not in existence unless they were revived, and that they were not revived by the convention of 1814 unless they were commercial treaties. I repeat that he admits this, for he says, "when the commercial treaties, including, I presume, those of 1783 and 1786, were revived."

Now, I think, I must have proved to the satisfaction of any reasonable person, that the treaties of 1783 and 1786 were not commercial treaties, and, therefore, that the convention of 1814, even in the opinion of Mr. Buchanan himself, did not revive them. Then they were never revived—then, they having been abrogated by the war, do not now exist, nor have they had any existence since the year 1796.

"When," says Mr. Buchanan, "did Great Britain renew her claim?" We claim ever since the year 1798, at which period we occupied, and have ever since continued to do so, the whole country between the Hondo and the Sarstoon, without any remonstrance from Spain, without expostulation or complaint of any kind.

Now I contend, and I believe I shall be borne out in my opinion by all writers on international law, that the British crown possesses a clear, substantial, indefeasible right to British Honduras, founded upon *usucaption* and *prescription.*

Vattel says, "Usucaption is the acquisition of domains founded on a long possession, uninterrupted, and undisputed, that is, on an acquisition solely proved by this possession. Prescription is the exclusion of all pretensions to a right founded on the length of time during which it has been neglected. * * Prescription being only founded on an absolute or lawful presumption, it has no place if the proprietor has not really neglected his rights. This condition implies three particulars:—1. That the proprietor cannot allege an invincible ignorance, either on his own part or that of his friends. 2. That he cannot justify his silence by lawful and solid reasons. 3. That he has neglected his right, or kept silence during a considerable number of years."

Now, let us see if these three conditions have been complied with. 1st. "That the proprietor cannot allege an invincible ignorance."

What is an invincible ignorance? It is not wilful ignorance, it is not an ignorance arising from forgetfulness and inattention,—but it is an ignorance which exists notwithstanding the most active and the most earnest endeavours to find out the truth. I will state the definition which the Roman Catholics give of invincible ignorance, which probably we may, as good Protestants, not be disinclined to adopt, inasmuch as it is borrowed from St. Augustine: "Catholic divines and the holy fathers, at the same time that they strictly insist on the necessity of adhering to the doctrine and communion of the Catholic Church, make an express exception of what is termed invincible ignorance, which occurs where persons out of the True Church are sincerely and firmly resolved, in spite of all worldly allurements, on the one hand, and of all opposition on the other, to enter into it if they can find it out, and when they use their best endeavours for this purpose." Now, taking this as a correct definition of invincible ignorance, and it is in this sense, in my opinion, that Vattel uses the expression, can Spain plead an invincible ignorance of the British possessions of Hon-

duras? Of the exercise of territorial rights on the part of the British Crown in Honduras? Of the commission of acts and deeds in Honduras expressly prohibited by the treaties of 1783 and 1786? Has she made every inquiry? Has she adopted every means within her power? Has she conscientiously, sincerely, and earnestly sought information? And, notwithstanding all her endeavours, has she been for the last sixty years in profound ignorance that Honduras was in the possession of the British Crown, and was treated by her as an absolute dominion? The supposition is too absurd. Pass we then on to the next condition.

2. "That he cannot justify his silence by lawful and solid reasons."

Assuming Spain to have been silent in respect to her supposed rights, what lawful and solid reasons can she allege to account for that silence? I am not aware of any reasons. Perhaps Mr. Buchanan may know of some; but until he publishes them to the world, I will assume that none exist, nor ever have existed.

3. "That he has neglected his right, or kept silence for a considerable number of years."

That Spain has done this, can, I think, be very clearly proved. The 4th article of the Convention of 1786, after stipulating that no fortification shall be erected, nor any body of troops posted, nor any piece of artillery kept at St. George's Key,* concludes as follows:—"And in order to verify with good faith the accomplishment of this condition *sine qua non* (which might be infringed by individuals, without the knowledge of the British Government), a Spanish officer or commissary, accompanied by an English officer or commissary, duly authorised, shall be admitted twice a-year, to examine into the real state of things."

At the end of the convention, there is the following declaration, signed by the Plenipotentiaries:—

"At the time of exchanging our Sovereign ratifications of this convention, signed the 14th of July last, we the undersigned Ministers Plenipotentiaries have agreed that the right of the English and Spanish commissaries, mentioned in the 4th article with respect to the island of Cago Casina, is to extend in like manner to all the other places, whether in the islands or on the continent, where the English cutters shall be situated. In witness, &c."

Up to the year 1796, a period of ten years, the Spanish commissaries made with the greatest regularity their half-yearly visits. Since that period, such a person as a Spanish commissary has never been seen at St. George's Bay, or in any part of British Honduras. The fact is undisputed, that for the last sixty years no commissary has been despatched from Spain. "Oh, but," says Mr. Buchanan, "the convention of 1814 revived all commercial treaties, and I suppose those of 1783 and 1786 were included." What Mr. Buchanan's supposition may be is a matter of little consequence; it was clearly not the supposition of Spain, or else why not send the Spanish commissary as agreed to by the latter treaty? But no commissary did she ever send. Here, then, is conclusive evidence, if Spain considered that her right to British Honduras still existed, that she neglected that right. But has Spain, by her representative at the Court of St. James's, ever remonstrated with the British government on the fact of that government treating Honduras as a dominion of the British Crown? Have they said, "You have sent soldiers, you have planted artillery, you have erected Courts of Justice, you have appointed a Governor, who, although called a superintendent, is a Governor to all intents and purposes. Now, all these acts you must be aware are in direct violation of the express terms of the treaties, which, though abrogated by the war, were revived by the Convention of 1814. It is, therefore, my duty to inform you, that this state of things must be put an end to; it is not to be tolerated any longer. Those soldiers must be sent from the country; that artillery must be shipped off; those Courts of Justice must be dissolved; your House of Assembly must 'be no longer a Parliament,' as a distinguished personage of your country said on a memorable occasion, and your superintendent, as you choose to call him, and all other officers not authorised by the treaties, must be sent about their business." Has Spain, I say, by her representatives, ever spoken in this language? No, nor anything like it. On the contrary, she has always exhibited the most meek and lamblike submission to our possession of the country; and it is my opinion that nothing would so much disconcert her as to say to her, "Honduras has been a bone of contention between America and us for sometime. We are tired of this dispute. Here, the country is yours: take it and keep it." It is not difficult to imagine what sort of a reply she would make to such a liberal offer. "Why, we can hardly keep Cuba out of the rapacious grasp of those filibustering Yankees;—Cuba, which contributes twenty millions of dollars a year to our exchequer; and do you wish us to be burdened with Honduras, that won't pay us a single cent? No, no, keep, keep it in Heaven's name."

It is quite evident, then, that our title to British Honduras by usucaption and prescription is an indefeasible one; that the conditions laid down by Vattel have been complied with. "1st. That the proprietor cannot allege an invincible ignorance. 2nd. That he cannot justify his silence by lawful and solid reasons. 3rd. That he has neglected his right, or kept silent for a considerable number of years." But the right of Great Britain to British Honduras has been recognized by various countries, by their sending consuls there, and demanding of the British exequaturs for those consuls. The United States sent a consul, Guatemala sent a consul, Spain sent a vice-consul, France sent a vice-consul, and there is a Mexican consul there at the present moment. But what does that signify? Mr. Buchanan is not frightened at that or any other difficulty. His gauntlet is always ready, and his trenchant blade glitters in the air, and he slashes away at what would terrify other people. He reminds me of the Frenchman's eulogistic song about General Jackson, in "Matthews's Trip to America:"—

> "They come ten thousand strong,
> But what was that to Jackson
> He was always ready for action,
> He beat them every one."

Mr. Buchanan would have been an admirable subject for the laudatory lyrics of the Gallic songster. "He is always ready for action, and, like Hotspur, in the way of bargain he will cavil on the ninth part of a hair." Hear what he says about the appointment of consuls. "The appointment of a consul recognises nothing more than the *de facto* possession of the post by the power from which his *exequatur* is received. Such an appointment does not in the slightest degree interfere with the question of the right *de jure* of this power to be in possession. This has ever been, and this must ever be, the law and practice of modern commercial nations. If it were otherwise, then, before the appointment of a consul, the government of a nation must first carefully inquire whether the party in possession be the rightful owner of the port, and if they determine against its right, then the commerce with it must cease altogether, or remain without consular protection. This would be a novel doctrine to maintain in the present age of commercial progress."

It would not be difficult to expose the fallacy of this reasoning, but I am spared the trouble of doing so, inas-

* St. George's Key is a small island, about nine miles from Belize. It was called by the Spaniards Casina, and sometimes Cago Casina. Casina signifies a farm-house or cottage, and Cago a rock or small islet in the sea. The sea, for upwards of 100 miles near the coast of Honduras is a complete archipelago, being covered with innumerable keys or islets. These give it the appearance rather of an enclosed lake than a part of the ocean.

much as it has been sufficiently answered by Mr. Clayton, another American statesman, of considerable learning and ability. That gentleman, in a letter addresed to Messrs. Gales and Seaton, Washington, dated January 7th, 1853, says, "The British title to the Central American States was recognised by Mr. Polk, in sending there Mr. Christopher Hempstead as consul, who remained in British Honduras, under the protection of the British flag, and in virtue of an exequatur obtained by Mr. Buchanan from the British Government, nearly three years, till I recalled him to prevent the possibility of any charge against General Taylor's administration of having recognised the English authority in Honduras."

Mr. Clayton speaks like an honest man. He says plainly and distinctly that Mr. Polk, the President of the United States, did recognise the British title by sending a consul to Honduras, and that when General Taylor became President, he recalled him, in order that he, General Taylor, should not be accused of recognising that title.

Mr. Clayton's letter to Mr. Hempstead, dated March 1st, 1850, is curious. He says, "As it is presumed that the appointment of a consul of the United States at Belize, even if required by our trade with that port, may have been made without full consideration of the territorial rights of Great Britain in that quarter, it is deemed advisable, under existing circumstances, to discontinue that consulate."

So the appointment of a consul at Belize was quite an accidental occurrence. It was not fully considered. Consuls had to be appointed at various places, and one at Belize was nominated by chance. This reminds me of the humorous observations made by Mr. Burke, in the course of his speech on the subsidiary treaty with the Landgrave of Hesse-Cassel. He said :—"That although the King of Prussia had professedly set out merely to obtain adequate satisfaction for the injury done his sister, his army, by accident, took Utrecht, possessed themselves of Amsterdam, restored the Stadtholder and the former government, and all this at a stroke, and, by the bye, which put him in mind of a verse in Cowley's sprightly ballad of the "Chronicle":—

> 'But when Isabella came,
> Arm'd with a resistless flame,
> And th' artillery of her eye,
> Whilst she proudly march'd about,
> Greater conquests to find out,
> She beat out Susan—by the bye.'"

And so, also, I suppose, Mr. Hempstead's appointment was made. It was, no doubt, true that Mr. Polk did not make that appointment; it was true that Mr. Buchanan applied to the British Government for his exequatur; and it was true that, for three long years, the flag of the Union fluttered in the breeze, before Mr. Hempstead's house, in all its stellary magnificence and glory, but all this was accidental, and, by-the-bye, "it was done without consideration." But the moment the subject was considered—the moment it was discovered what a *mauvais pas* Mr. Polk had made, an attempt was made to repair the mischief, and Mr. Hempstead was ordered, without loss of time, to pack up his stars and pocket his stripes.

But, assuming Mr. Buchanan's argument to be correct, namely, that the appointment of such an officer does not recognise the right, but only the fact of the governing power, why does he not now send a consul to Belize? In a letter published in the *New York Weekly Herald* of Dec. 12th, by whom written I have not the slightest idea, I find the following statement, of the correctness of which there can be no question. The writer, having spoken of Spain, France, and Mexico, says:—"All of these governments united have not half of the commercial transactions which the United States has with this settlement; and yet, with five vessels continually trading between here and the United States, with a vast amount of business, of great interest to the United States, continually being transacted between the two places, the United States has no consul. Not only does the United States lose a portion of her revenue, but many of her citizens engaged in this trade are subjected to loss and imposition, for the want of a consul here, to assist masters in distress, and to protect American interests."

Honduras is supplied with provisions principally from Boston, New York, and New Orleans. Almost all the pork, flour, hams, cheeses, butter, lard, potatoes, and candles, come from those ports. Also, champagne, claret, and dried fruits. Likewise a large amount of iron wire of different descriptions. I ask again, then, why does not Mr. Buchanan send a consul to Belize, seeing that such a proceeding would not be a recognition of the British title? Because he knows that his argument is hollow,—that his reasoning is fallacious,—and that by sending a consul to Belize, he would acknowledge the right of Great Britain to British Honduras.

(To be continued.)

THE ATLANTIC TELEGRAPH.

The experimental expedition for trying in deep water the proposed operations for laying down the telegraphic cable between England and America, has completed its objects, and returned to the Sound on Thursday, 3rd inst., having been absent five days. The ships composing the squadron were the *Agamemnon*, the *Niagara*, the *Valorous*, and the *Gorgon*, and they left the Sound at about four o'clock on Saturday, May 29. The weather was extremely fine, and beyond the steady swell which always rolls off the western shores of Great Britain, the sea was perfectly calm, and both the sea and air promised to be in a very favourable condition for the prosecution of the experiments. When the squadron had reached the appointed rendezvous, a little north of Cape Ortegal, and about 120 miles north-west of the Port of Corunna, the whole of the ships lay to, and soundings were taken, which showed a depth of about 2,530 fathoms, or nearly three statute miles. The result of the soundings having been conveyed by signal to all the ships of the squadron, the *Agamemnon* and *Niagara* were backed close together, stern on, and a strong hawser passed between them to keep them in that situation. The end of the cable was then conveyed by boats from the *Niagara* to the *Agamemnon*, where the splice was safely made. The way in which the splice was made is stated to be effectual in neutralising the evil effects which it was supposed would result from the lay of the two portions of the cable being in opposite directions. A semicircular frame of strong wood was employed, some 15 feet long, and rather broad and thick towards the centre. In this deep grooves were cut, in which the cable was laid, each end passing in at the arms round two eyes in the centre of the crescent, and out at the sides, where the actual joining was made. By this method the strain of the splice was confined entirely to the ends inside the half-moon, while on the actual junction of the cable outside no tension of any kind could come. In order to keep the cable ends in their place around the blocks and within the grooves, a strip of boiler-plate of the same size as the wooden frame was bolted on to it, while to prevent the two portions of the cable untwisting, and to sink it rapidly, a heavy weight was attached to the centre. The splice having been effected, it was lowered overboard, and the two vessels payed out one mile of the experimental cable with the greatest ease. The dynamometer employed was found accurately to register the calculated strain on the cable at different depths. The engineer in charge of the brakes stands facing the graduated scale, and throws off the weights as he sees the vessel lurch and the strain upon the cable rising in proportion, while on the contrary, when the dynamometer indicates the tension at a low standard, and the cable running away

too quickly, the brakes are suffered to close again with ease. It was determined to try the effect of hauling the cable in again from different depths. The hauling-in gear and engine were put in action, and half a mile of the cable recovered with the greatest ease. A further experiment was then determined on, and two miles having been payed out, the wire was allowed to rest for a few minutes, to make sure that the splice went down as far as the length of the cable would let it. A telegraphic message was then conveyed to the *Niagara* to commence hauling up, and both donkey engines were set in motion simultaneously. The enormous weight of the amount of cable out, and its friction on the water equally balanced the power of the *Agamemnon's* donkey engine, and it was only by the aid of handspikes and crowbars that it was kept revolving at all, the strain being two tons five cwts. After about a quarter of a mile of the cable had been reeled in, the weight and friction were sufficiently reduced to give the engine the advantage, and the reeling continued steadily, at the rate of about one mile an hour. During the operation, however, an accident occurred, which brought the wire into contact with the hawser which connected the *Niagara* with the *Agamemnon*, and this was cut through. The *Niagara*, having nothing to hold her, soon drifted away from the *Agamemnon*, and, as a natural consequence parted her end of the cable about half a mile from the splice. The splice, however, was after a time recovered by the hauling gear on board the *Agamemnon*, and the results of its immersion in such extremely deep water were interesting. The frame was penetrated to the very centre by the salt water, from the enormous pressure to which it must have been subjected, which it was calculated could not have been less than 8,000lbs. to the square inch. Both the wooden frame and the iron rod attached to it were considerably bent and twisted, and showed evident traces of having been turned round with considerable velocity while below the surface. The cable, within some twenty fathoms of the frame, was also much knocked and strained. Various other experiments were made, in the course of which the cable was subjected to very severe strains, which more than once caused it to part. The experiments are, however, stated to have been, on the whole, satisfactory, and though several slight alterations in the machinery and the general arrangements have suggested themselves to the engineers, the new paying-out machine is considered to have fulfilled the most sanguine expectations which were formed of it, only requiring a few trifling alterations in the mechanical adjustments.

SOUTH KENSINGTON MUSEUM.

During the week ending 5th June, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,774; on Monday and Tuesday (free evenings), 3,242. On the three Students' days (admission to the public 6d.), 763; one Students' evening, Wednesday, 96. Total, 6,875.

Proceedings of Institutions.

Kandy (Ceylon).—The committee of the Agri-Horticultural Society, in presenting their report for the year 1857, state that their attention has been much directed to the consideration of the important benefits that would result, not only to Ceylon, but to the home manufacturers, from an extended cultivation of cotton. It is certain that a very large extent of this island is well adapted for the growth of cotton, and there is little doubt that this article might, in some districts, be produced with profit to the cultivation. The Cotton Supply Association of Manchester has shown a readiness to assist in the development of an extensive cotton production, having offered to place at the disposal of this Society ten pounds, as a prize to be given to the producer of ten bales, and upwards, of the best cleaned Kandy grown cotton, equal to American middlings in staple and quality; and a further sum of five pounds to the producer of not less than five bales of similar cotton. They have, moreover, promised to supply suitable seeds, and gins for cleaning the cotton, &c., and to send a number of copies of an excellent treatise, on the best mode of cultivating cotton known in the Southern States of America, and any other additional information it is in their power to communicate. The committee feel that the most effective stimulant to cotton cultivation on an extended scale, would be the giving facilities for the disposal, without much trouble or delay, and at a fair market price, of the cotton produced. To this they will direct the attention of the Cotton Supply Association, assuring them at the same time that they will use their best endeavours to encourage the cultivation, and by the distribution of seeds, &c., to improve the quality of the article produced. Some apparently very good samples of cotton had been exhibited to the Society, and it was hoped that the producers would be able to supply it in sufficient quantity to enable judgment to be formed of its value. The attention of the committee had also been engaged in the consideration of the influence that forests have in keeping up a regular flow of water in streams taking their origin amongst them. A paper on this subject had been laid before the Society. The committee urge upon the members the desirableness of their obtaining, in their several districts, all the reliable information they can procure, as to whether the supply of water in the streams has been affected by the felling of the forests, and whether, and to what extent, the effect, if any, has been counteracted by the subsequent growth of the coffee trees. An interesting collection of dye woods had been exhibited at the last show. Vanillas, of excellent quality, had been sent from the Royal Botanical Gardens, and shown, as well as good samples of tobacco, and an extensive collection of gums, resins, and oils, which were considered of sufficient importance to be entitled to a gold medal. The committee think it desirable not to have an exhibition this year, unless it can be shown to them that a large number of persons are prepared to take some trouble to make it more generally attractive, by bringing fruits and flowers in sufficient number to produce a striking display. The committee trust that when the exhibitions of the Society are renewed, specimens of an improved breed of cattle and of other animals, &c., will be forthcoming, as this is too important a subject, in reference to the best interests of the island, to be neglected. The committee have no doubt that much attention will be shortly given to the subject of fibres, as the government has ordered from England two of Mr. Burke's machines for exhibition in the botanical gardens.

London.—Mr. T. J. Pearsall has been appointed Corresponding Secretary of the London Mechanics' Institution. It is earnestly to be hoped that, with vigorous management within, and the support of its members and students without, a new career of usefulness may be opened for this, the parent Mechanics' Institution of the country, and that the friends of adult education will use every effort in furtherance of so desirable an object. On Wednesday, June 9th, Mr. T. A. Reed gave a lecture on "Speech and its Marvels." The lecturer pointed out the groups of sounds usually uttered to compose human language, and the distinct articulations required even for a single word, showing the wondrous anatomical powers called into requisition. He did not concur in the popular idea that children were a long time learning to speak. On the contrary, he could not but express his surprise that infants so soon mastered the difficulties of speech. Special attention was drawn to the great rapidity with which words could be enunciated, some fluent speakers even approaching the rate of 300 words per

minute. Mr. Reed, at a certain point, stated that up to that period, in one hour, more than 8,000 distinct articulations had been made to convey his meaning. The lecture was received with great attention by the audience.

Sheffield.—The last report of the Church of England Educational Institute states that its progress during the past year has been most satisfactory. The highest number of names on the books in any quarter of the year 1856 was 152. In the first quarter of last year the number was 238; in the spring quarter it was 200; and in the winter now closing the number reached 251; a number unparalleled in the experience of this Society. The number of persons who have, during the past year, attended the classes is about 400. The students may be divided, with respect to regularity of attendance, into two portions: 1st, those who constantly attend and steadily apply; and 2nd, those who only come for one or two quarters, who, during that time, attend only one or two of the more entertaining classes, and who show, by their conduct in class, that they come for amusement rather than instruction. The latter portion of the students, undoubtedly, receive much benefit. They get a glimpse of higher subjects; become in some measure sensible of their own ignorance, and are altered at least, in outward demeanour and general taste. This, however, is not a promising class. It is to the regular, steady, hard-working student that the teacher looks for a display of the advantages of education. In him are gradually exhibited correctness of judgment, decision of purpose, habits of perseverance, elevation of morals, and enlargement of mind. It will thus be seen that a large number of irregular attendants is not a great advantage, but that the efficiency of such an Institution is chiefly to be measured by the number of constant attendants. The Committee have great pleasure in reporting that a very considerable portion of the students are of the latter satisfactory class. Nineteen years is, as it was last year, the average age of the students, while the immense majority continue to be composed of artizans. Several of the senior students have, during the last quarter, undertaken the tuition of junior classes, and the number of such teachers may be expected very considerably to increase. The society possesses the efficient assistance of many masters of the Church of England day schools, while at the same time the staff of teachers has been considerably recruited from other quarters. Many new classes have been formed, and in general efficiency the Institute has been much improved since the former year. New classes have been formed for the study of Trigonometry, of Roman and English History, and the French and Latin Languages; in these and other classes the books recommended by the Society of Arts are used as text-books. The library continues a source of much interest to the students, more than 2,700 volumes having been taken out during the year. The number of books in the library is steadily increasing, and the thanks of the members are due to the Sheffield Book Club for their very generous contributions. The financial position of the Society is equally encouraging with the rest of its proceedings. After discharging all necessary expenses, its annual income presents a most satisfactory surplus, and it is especially gratifying to know that this surplus is in a great measure due to the large increase in the contributions by students. In 1856 the increase of contributions from this source amounted to £32, while last year there was a further increase of £24. The erection of a new building for the purposes of the Institute has become absolutely necessary. The nightly attendance of students is so large, and the number of classes so great, that additional rooms are required for their accommodation. On account of the present inconvenient arrangements, the committee cannot invite first-class lecturers, nor afford the accommodation they could desire to the families of annual subscribers.

Slough.—The last report of the Mechanics,' Literary, and Scientific Institution, states that at the time of its publication the Institution comprised 194 members. The resources of the Institution have steadily increased, both in the number of its members and the amount of its revenue. From purchases and donations, an addition of no less than 140 volumes had been made to the library during the year. The committee have much pleasure in reporting the continuance and progress of the drawing classes, under the kind and gratuitous superintendence of James Chapman, Esq., assisted by Mr. George Dorrell. The Hon. Secretary, Mr. G. Kershaw, voluntarily conducts the singing class upon the Hullah system, and his efforts appear to be thoroughly appreciated by the members. The Institution had been admitted into union with the Bucks and Berks Lecturers' Association, several of whose members would deliver lectures during the session.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Architects, 8. I. The Discussion on Mr. Burgess' Paper will be resumed. II. Mr. Wyatt Papworth, "Notes on the assumed use of Chestnut Timber in the Carpentry of Old Buildings."
Geographical, 8½. I. Messrs. Green, Hahn, and Rath, "Account of an Expedition from Damara Land to the Ovampo, in Search of the River Cunene." II. Lieut. C. A. C. De Crespigny, "Ascent of the River Limbong, Borneo." III. Mr. Thomas Hopkins, "On the Fine Regions of the Trade Winds." IV. Mr. J. Turnbull Thomson, "Survey of the Southern Districts of Otago, New Zealand."

Tues.......Statistical, 8. I. Mr. Welton, "On the Occupations of the People of England and Wales." II. Mr. Willich, "On the Population of England and France." III. Mr. Roberts, "Report on the Congres de Bienfaisance at Frankfort, 1857."

Wed. ......Microscopical, 8.

Thurs. ...Philosophical Club, 5½.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8. Dr. Hofmann, "On Ammonia."
Philological, 8.
Royal, 8½.

Sat..........Asiatic, 2.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 22nd, 27th, and 28th May, 1858.

94. Bills—Public Grounds and Playgrounds.
96. ——— Bishops' Trusts Substitution (No. 2).
Education—Minutes of the Committee of Council.
Sanitary Condition of the Army—Appendix 79.

Delivered on 29th and 31st May, 1858.

98 (A 3). Poor Rates and Pauperism—Return (A).
594. Royal Hibernian Academy—Return.
295. Navy (Seamen and Petty Officers)—Return.
296. New Zealand Loan—Return.

Delivered on 1st June, 1858.

276. Vessels and Tonnage, &c.—Return.
291. Poor Relief, &c. (Metropolis)—Return.

Delivered on 2nd June, 1858.

113. Harbours, &c. Bills (19. Clyde Navigation—Supplemental Report from the Board of Trade.
292. Army Clothing, &c.—Returns.
97. Bill—Bishops' Trust Substitution (No. 3).

Delivered on 3rd June, 1858.

270. Bleaching and Dyeing Works—Report from Committee.
297. Westminster New Palace—Copy of Further Correspondence.
302. East India (Letters and Collections, &c.)—Return.
303. East India (Civil Service Examinations)—Copy of Letter.
307. East India—Copy of Letter to the Governor-General.

Delivered on 4th June, 1858.

305. Printing—Copy of Treasury Minutes.
309. Ordnance Survey (Scotland)—Return.
98. Bills—Vaccination (Ireland).
99. ——— Drafts on Bankers' Law Amendment.
Public General Acts—Cap. 17, 18, 19, and 20.

Delivered on 5th and 7th June, 1858.

306. Reformatories—Return.
308. Gilbert-street Calamity—Return.
319. Contracts (Public Departments)—1st Report.
95. Bills (Titles to Land (Scotland).
101. ——— Marriage Law Amendment (Amended).
102. ——— Nisi Prius Court (Ireland).
100. ——— Insurance Assurance Institutions.
107. ——— Law and Property Amendment.

Delivered on 8th June, 1858.

301. Army (Captain Grant's Kitchens)—Copies of Reports.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette*, *June* 4, 1858.]

Dated 15th March, 1858.

524. W. G. Taylor, Ashby-de la-Zouch, Leicestershire—Imp. in preparing skins for tanning.

Dated 17th April, 1858.

834. Grassay, Ivry, Rue du Chevaleret, 7, Paris (Seine)—Hangings and all sorts of papers, made waterproof by a new process.

Dated 24th April, 1858.

906. J. Luis, 1B, Welbeck-street, Cavendish-square—A moderator piston. (A com.)

Dated 30th April, 1858.

964. B. L. A. Peaucellier, Paris, Boulevard Bonne Nouvelle, No. 10—An improved plough.

Dated 5th May, 1858.

1002. D. E. Hughes, New York—Imp. in the means of, and apparatus for, transmitting signals and electric currents.

Dated 8th May, 1888.

1036. A. V. Newton, 66, Chancery-lane—An improved manufacture of hard and waterproof fabric, and the application of the same to the construction of boats, parts of carriages, and of furniture, portmanteaus, and travelling cases, and vessels of capacity. (A com.)

Dated 12th May, 1858.

1062. J. Henderson, Glasgow—An improved apparatus for measuring fluids.

Dated 17th May, 1858.

1093. D. W. Hayden, 75, Pratt-street, Camden-town—Imp. in boilers for agricultural or domestic purposes.
1095. E. Tombs, 4, Waterloo terrace, Islington—Imp. in the manufacture of ruche and other trimmings for ladies' apparel, applicable also to making cap fronts and other fluted fabrics.
1097. W. H. Bagnall, Masbro', Yorkshire—Imp. in stove grates.
1099. C. W. Harrison, Woolwich—Imp. in obtaining light by electricity.
1101. H. Curzon, jun., Kidderminster—Imp. in preparing printed yarns.
1103. R. Imeary, Gateshead, and T. Richardson, Newcastle-on-Tyne Imp. in roasting small or disintegrated pyrites.

Dated 18th May, 1858.

1105. J. Higgins, Oldham—Imp. in preventing explosions in mines, and in the machinery or apparatus employed therein.
1107. A. A. Croll, Coleman-street—Imp. in the treatment of sulphate of alumina, and in obtaining alum.
1109. S. Higgs, jun., Penzance, Cornwall—Imp. in miners' safety lamps.

Dated 19th May, 1858.

1111. J. Brown, Smethwick, Staffordshire—Imp. in the manufacture of iron, and in rolling iron and steel, and in machinery to be employed therein.
1113. W. Mac Naught, Manchester, and W. R. Critchley, Salford—Imp. in the manufacture of copper or other metallic rollers or cylinders for printing fabrics, and in apparatus connected therewith.
1115. J. Bottomley and A. H. Martin, North Brierley, near Bradford—Imp. in means or apparatus employed in weaving.
1117. C. M. Kernot, M.D., Gloucester-house, West Cowes, Isle of Wight—Imp. in distilling shale, boghead, and other mineral matters.
1119. W. F. Snowden, Longford, Gloucestershire—An improved construction of chaff and litter cutting machine.
1121. M. Henry, 84, Fleet-street—Improved apparatus for communicating, or transmitting, or producing fac-simile copies of dispatches, intelligence, or messages, or characters, drawings, or devices. (A com.)

Dated 20th April, 1858.

1123. M. Brun, Vienne (France)—Imp. in dyeing.
1125. H. Brierly, Manchester—Imp. in mules for spinning.
1127. J. Boydell, 65, Gloucester-crescent, Camden-town—Imp. in machinery for propelling vessels.

Dated 21st May, 1858.

1129. T. Settle, Bolton le-Moors, Lancashire—Certain imp. in machinery or apparatus for preparing, slubbing, and roving cotton and other fibrous materials.
1131. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in machinery for making bolts. (A com.)
1133. J. Adamson, St. John-street-road—Imp. in the manufacture of parts of gas meters.
1135. J. Apperly and W. Clissold, Dudbridge—Improved machinery for condensing wool and other fibrous substances.
1137. J. Sholl, Victoria-grove West, Stoke Newington—Imp. in the manufacture of paper used for letter-press, lithographic, and copper-plate printing, and for other purposes.

Dated 22nd May, 1858.

1139. J. Elce and J. Champion, Manchester—Imp. in parts of machinery used in preparing and spinning cotton and other fibrous substances.
1141. J. Ronald, Liverpool—Imp. in dressing hemp, flax, and other fibrous materials.
1143. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus serving the purposes both of saponification and of decomposing neutral fatty substances into fatty or oily acid and glycerine. (A com.)
1145. F. G. Underhay, Wells street, Gray's inn-road, and J. L. Clark, Haverstock-hill, Hampstead—Imp. in cocks or taps, and in apparatus for flushing.
1147. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in curtain rods. (A com.)
1149. A. P. Price, Margate—Imp. in the treatment of certain zinc ores and compounds of zinc, and in the manufacture of zinc and oxide of zinc.
1151. A. Ellissen, Throgmorton-street—Imp. in signalling in railway trains.
1153. G. F. Parke, Lower Smith-street, Clerkenwell, and J. Briant, Curtain-road—Imp. in bonnets.

Dated 24th May, 1858.

1155. R. L. Hattersley, Keighley, Yorkshire—Imp. in looms for weaving.
1157. M. Stevens, Holywell, Flintshire—Imp. in machinery for pulping straw and other vegetable fibres.
1159. W. Harding, Forest-hill, Kent—Imp. in revolver fire-arms.

Dated 25th May, 1858.

1161. Prince A. Galitzin and S. Souschkoff, Paris, Boulevart de Strasbourg, 60, and P. E. Guérinot, Paris—An improved apparatus intended to prevent boats or ships to be destroyed and sunk when running full against each other.
1163. W. Webster, Washington, U.S.—Improved machinery for the propulsion of vessels.
1165. W. Webster, Washington, U.S.—An improved method of rigging vessels.
1167. C. F. Vasserot, 45, Essex-street, Strand—An improved construction of rails for fences and gates. (A com.)
1169. G. Alton and J. Fernie, Derby—An imp. in the construction of steam boilers and other vessels capable of resisting pressure, and in the manufacture of plates for the same.
1171. J. Courage, Horsleydown—Imp. in furnaces for smelting and calcining.
1173. R. C. Witty, Mitcham, Surrey—Imp. in protecting ships of war and land batteries and fortifications from injury from shot and other projectiles.

Dated 26th May, 1858.

1175. R. H. Nicholls, 42, St. Michael's-hill, Bristol—Imp. in taps or cocks for drawing off ale or other liquids.
1181. G. Cheadle, Wolverhampton—A new or improved flooring cramp.

WEEKLY LIST OF PATENTS SEALED.

June 4th.

3009. J. Rubery.
3012. J. Grizard.
3013. W. Standring.
3014. A. Morton and J. Howden.
3020. W. T. Henley.
3030. J. Harris.
3033. B. Shaw.
3038. W. J. Ward.
3041. R. A. Brooman.
3062. F. Walton.
3116. A. Lees and J. Clegg.
3154. A. W. Williamson.
3159. G. Croft and S. D. Steel.
3171. H. Deacon.
3174. H. Desmoutis.
14. J. Ellis and J. H. Ellis.
153. L. Caemmerer.
155. J. H. Johnson.
438. C. Boyce.
569. T. C. Medwin.
651. B. Burrows.
693. E. A. Colette.
731. R. Hornsby, junr.
760. T. Greenwood, J. Batley, and J. Dockray.
781. D. McCrae.

June 8th.

3046. J. Smith.
3047. J. Haddon.
3138. R. F. Sturges.
3140. S. Rodgett and D. Rodgett.
3149. C. N. Nixon.
59. N. E. Jeanroy.
84. W. Waller.
394. W. A. Gilbee.
413. A. V. Newton.
441. C. F. Vasserot.
747. G. W. Baker.
841. M. A. F. Mennons.
843. M. A. F. Mennons.
919. A. F. Emery.

Patents on which the Stamp Duty of £50 has been Paid.

June 1st.

1274. G. Green.
1279. W. Baines.
1413. U. Lane.

June 2nd.

1273. E. Morewood and G. Rogers.

June 3rd.

1268. P. A. Godefroy.
1272. W. Eley.
1300. J. Buncle.

June 4th.

1292. G. Hopper.
1294. J. Robertson.
1343. H. W. Ford.

June 5th.

1295. H. Nunn.
1299. J. Ramsbottom.
1355. G. A. Biddell.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4094	June 4.	The Epaulette or Double-shouldered Shirt	McIntyre, Hogg, and Co.	26, Addle-street, Wood-street, London.
4095	,, 2.	Inkstand	M. Phineas	12, Bold-street, Liverpool.

Journal of the Society of Arts.

FRIDAY, JUNE 18, 1858.

SEVENTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Seventh Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on Thursday next, the 24th of June, at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference, as matters connected with the arrangements for the next year's Examinations will, amongst other subjects, be brought under consideration.

ANNUAL DINNER.

The One hundred and fourth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Thursday next, the 24th instant, at half past five for six o'clock punctually. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may now be had at the Society's House. The Rt. Hon. the Earl of Carlisle, K.G., will preside.

PROPOSED ECONOMIC MUSEUM.

It may interest some of the Representatives of the Institutions in Union to know that a few sections of this Museum, designed for the instruction and benefit of the working classes, will be exhibited and explained, next week, at the Royal Polytechnic Institution, in Regent-street. One of the chief objects of the collection is to show how Mechanics' Institutions, schools, and other public and private establishments may form analogous collections, in a limited space, and at a moderate expense.

A special Library is attached to the proposed Museum, for the purpose of collecting and diffusing information of every kind on the condition of the industrial population, and the means of improving it. An explanatory notice of the collection may be had on application at the Society of Arts, or to Mr. Freeman, the special curator, at the Polytechnic Institution.

SWINEY LECTURES ON GEOLOGY.

A course of twelve lectures, in connection with the Swiney bequest to the British Museum, is now in the course of delivery at the Museum of Practical Geology, Jermyn-street, on Monday, Tuesday, Wednesday, and Thursday in each week, at 3 o'clock p.m., by Alexander Gordon Melville, M.D., Professor of Natural History in the Queen's University, Ireland.

1. June 14.—Subject-matter of Geology. Classes of Rocks.
2. „ 15.—Composition of Rocks. Stratification.
3. „ 16.—Igneous Action. Volcanoes, Earthquakes.
4. „ 17.—Elevation and Plication of Rocks. Faults.
5. „ 21.—Cleavage and Foliation, or
6. „ 22.—Denudation. Unconformability.
7. „ 23.—Lower Silurian System of Rocks.
8. „ 24.—Upper Silurian System of Rocks.
9. „ 28.—Devonian System.
10. „ 29.—Carboniferous System (Marine Series).
11. „ 30.—Carboniferous System (Coal-measures.)
12. July 1.—Permian System.

Admission gratis.

EXAMINATIONS, 1858.

PRIZES AWARDED TO CANDIDATES.

Arithmetic	1st Prize	£5	To No. 29—George William Wicker, aged 18, of the Watt Institute, Portsea (Portsmouth)—A Working Engineer.
	2nd Prize	3	,, 474—Frederick William Potter, aged 18, of the Crosby-hall Evening Classes, London—Clerk.
Book-keeping	1st Prizes	5	,, 25—George Harrison, aged 21, of the Young Men's Christian Institute, Leeds—Book-keeper.
		5	,, 37—George Edward Skinner, aged 21, of the Literary Institution, Lymington—Attorney's Clerk.
	2nd Prizes	3	,, 217—James Dawling Bennett, aged 18, of the Royal Polytechnic Institution, London—Gas Engineer.
		3	,, 474—Frederick William Potter, aged 18, of the Crosby-hall Evening Classes, London—Clerk.
Algebra	1st Prize	5	,, 29—George William Wicker, aged 18, of the Watt Institute, Portsea (Portsmouth)—A Working Engineer.
	2nd Prize	4	,, 20—Alfred Pickard, aged 16, of the Young Men's Christian Institute, Leeds—A Mechanic.
	3rd Prize	3	,, 362—Francis Stone Evans, aged 18, of the Athenæum, Bristol—(Occupation not stated.)
Geometry	1st Prize	5	,, 16—William Wheater, aged 17, of the Young Men's Christian Institute, Leeds—Land Surveyor.
Menuration	1st Prize	5	,, 29—George William Wicker, aged 18, of the Watt Institute, Portsea (Portsmouth)—A Working Engineer.
Conic Sections	1st Prize	5	,, 362—Francis Stone Evans, aged 18, of the Athenæum, Bristol.
Chemistry	1st Prize	5	,, 496—George Warington, aged 17, of the Crosby-hall Evening Classes, London—Worker in a Chemical Laboratory.
	2nd Prize	3	,, 237—Frederick William Rudler, aged 17, Student of the Chemical Class, Royal Polytechnic (London)—A Solicitor's Clerk.

PRIZES AWARDED TO CANDIDATES (Continued).

Botany	1st Prize...	5	,,	496—George Warington, aged 17, of the Crosby-hall Evening Classes, London—Worker in a Chemical Laboratory.
Political Economy	1st Prize...	5	,,	483—Robert James White, of the Crosby-hall Evening Classes, London—Clerk.
Geography:—				
Descriptive	1st Prize...	5	,,	32—Richard Harper Stretch, aged 20, of the Banbury Mechanics' Institution—Draper.
	2nd Prize..	3	,,	53—George Best, aged 24, of the Mechanics' Institution, Leeds—Book-keeper.
Physical...	1st Prize...	5	,,	32—Richard Harper Stretch, aged 20, of the Banbury Mechanics' Institution—Draper.
English History.........	1st Prize...	5	,,	53—George Best, aged 24, of the Mechanics' Institution, Leeds—Book-keeper.
English Literature	1st Prize	5	,,	263—Edward Birks, aged 29, of the People's College, Sheffield—Bank Cashier.
	2nd Prize..	4	,,	258—Joseph Fox, aged 21, of the Mechanics' Institution, Halifax—Timber Merchant.
	3rd Prize...	3	,,	265—Joseph Hopkins Davy, aged 31, of the People's College, Sheffield—Grocer.
Latin and Roman History	1st Prize...	5	,,	264—William Thomas Hutchinson, of the People's College, Sheffield—Butcher.
Latin	2nd Prize...	3	,,	473—James Brady, aged 19, of the Crosby-hall Evening Classes, London—Carpenter.

No Prizes were awarded in Trigonometry; Navigation and Nautical Astronomy; Statics, Dynamics, and Hydrostatics; Practical Mechanics; Magnetism, Electricity and Heat; Astronomy; Animal Physiology; French; German; Free-hand Drawing; and Mechanical or Geometrical Drawing; as no Candidate obtained a First-class Certificate in any of these subjects.

PRIZES AWARDED TO LOCAL BOARDS.

The following prizes are awarded in accordance with the announcement made at page 439 of the *Journal.*

To the Local Board at Crosby Hall Evening Classes, London, one Prize of £10.
To the Local Board at the London Mechanics' Institution, Southampton-buildings, £4.

SPECIAL PRIZES TO INSTITUTIONS.

The Council have awarded a Special Prize of £10 to the Watt Institute, Portsea, the Institution in which Candidate No. 29, George William Wicker, is a Student.

The Council have decided that £5 be awarded to each Institution sending a Candidate that has obrained a First Prize. The following is a List of these Institutions:—

London, Crosby Hall, Evening Classes................................	£15
Portsea, Watt Institute	15
Banbury, Mechanics' Institution	10
Leeds Young Men's Christian Institute	10
Sheffield People's College	10
Bristol Athenæum	5
Leeds Mechanics' Institution	5
Lymington Literary Institution	5

AWARD OF CERTIFICATES.

ARITHMETIC.

First Class Certificates (Excellence).

Candidates Numbers.

22—Joseph Hough, aged 20, Young Men's Christian Institute, Leeds—A Mechanic.
25—George Harrison, aged 21, Young Men's Christian Institute, Leeds—Book-keeper.
29—George William Wicker, Watt Institute, Portsea—Engineer.
56—John Charles Froyne, aged 23, Mechanics' Institute, Pembroke Dock—Shipwright.
94—James Mills, junr., aged 20, Mechanics' Institution, Bradford—Warehouseman.
217—James Dawling Bennett, aged 18, Royal Polytechnic, London—Gas Engineer.
228—Samuel Dean Grimson, aged 16, Royal Polytechnic, London.
295—Daniel Charles Carmichael, aged 21, the Institute, Liverpool—Book-keeper.
336—John Stamford Walton, junr., aged 19, Mechanics' Institution, Northallerton.
341—Henry Irwin Jenkinson, Institute of Popular Science and Literature, York—Clerk.
362—Francis Stone Evans, aged 18, the Athenæum, Bristol.
468—John Joseph Goldsmith, aged 19, Crosby-hall Evening Classes, London—Architect's Clerk.
474—Frederick William Potter, Crosby Hall Evening Classes, London—Clerk.
485—Richard George Frost, Crosby-hall Evening Classes, London—Clerk.
487—John Cocking Fielden, aged 20, Literary, Scientific, and Mechanics' Institute, Blackburn—Book-keeper.

Second Class Certificates (Proficiency).

6—William Dean, aged 20, Mechanics' Institution, Wigan—Clerk.
9—James Platt, aged 20, Mechanics' Institution, Wigan—Lawyer's Clerk.
15—Thomas Myers, aged 19, Young Men's Christian Institute, Leeds—Railway Clerk.
20—Alfred Rickard, aged 16, Young Men's Christian Institute, Leeds—A Mechanic.
37—George Edward Skinner, aged 21, Literary Institution, Lymington—Attorney's Clerk.
41—John J. Chapman, aged 16, Literary and Mutual Improvement Society, West Brompton (London)—Clerk.
48—William Sterne, aged 20, Mechanics' Institution, Holbeck—A Mechanic.
54—Charles Thomas Barnes, aged 16, Mechanics' Institution, Leeds—Clerk.
67—James Dickie, aged 19, Mechanics' Institution, London—Clerk.
77—Thomas Hammond Harper, aged 16, Mechanics' Institution, Selby—Grocer.
78—Thomas Bedford, aged 28, Mechanics' Institution, Selby—Schoolmaster.
87—John Clark Wise, aged 17, Mechanics' Institution, Bradford—Woolsorter.
112—John Lowe, aged 21, Mechanics' Institution, Manchester—Turner.
230—Alfred Holloway, aged 18, Royal Polytechnic, London—Clerk.
248—John Leach, aged 16, Mechanics' Institution, Halifax—Clerk.
256—William Henry Boocock, aged 20, Mechanics' Institution, Halifax—Solicitor's Clerk.
262—Richard Shutt, aged 35, People's College, Sheffield—Saddler.
268—Thomas Dresser, aged 24, People's College, Sheffield—Post-office Clerk.
299—Thomas Wiltshire Brooke, aged 16, Coll. Institute, Liverpool—
300—Joseph Plair, aged 19, Coll. Institute, Liverpool—Clerk.
314—John Brammer, aged 16, Mechanics' Institution, Lockwood—Clothdresser.
332—Richard Cockroft, aged 18, Working Man's College, Haley-hill, Halifax—Warehouseman.
338—Thomas Henry Sowden, aged 17, Institute of Popular Science and Literature, York—Railway Clerk.
345—Alfred Prudames, aged 20, Mechanics' Institution, Berkhampstead—Veterinary Surgeon.
347—William Henry Abbey, aged 18, Mechanics' Institution, Berkhampstead—Clerk.
348—Anthony Slater, aged 18, Mechanics' Institution, Berkhampstead—Printer.
467—Robert Corney Harrison, aged 22, Crosby Hall Evening Classes, London—Clerk.
488—James Hodgson, aged 16, Literary, Scientific, and Mechanics' Institution, Blackburn—Plasterer.
492—Edwin Eccles Manning, aged 16, Society for the Acquisition and Diffusion of Useful Knowledge, Greenwich—Clerk.
493—Edwin Slowman Rous, aged 19, Improvement Association, Lewes—School Teacher.
502—Charles Arthur Hardwick, aged 16, Brighton.

Third Class Certificates (Competency).

11—John Allison Zachariah, aged 23, M. and Lit. Inst., West Hartlepool—Watchmaker.
12—Thomas Pearson Tate, aged 21, West Hartlepool Literary and Mechanics' Institution—Clerk.
26—John William Dixon, aged 19, Young Men's Christian Institute, Leeds—Printer.
28—Samuel Woodhead, aged 31, Mechanics' Institution, Northowram—Book-keeper.
30—Thomas William Smith, aged 19, Watt Institute, Portsea—Engineer.
40—Robert Freestone, aged 20, Lit. and M. I. Inst., West Brompton—Clerk.
43—Henry Logan, aged 17, M. I., Wakefield—Iron Moulder.
45—Joseph Albert Dear, Mechanics' Institution, Wakefield—Draper.
49—Joseph Staincliffe, aged 26, M.I., Leeds—Letter Carrier.
57—William Clark, aged 32, M. I., Pembroke Dock—Shipwright.
59—John Mumford, aged 19, Mechanics' Institute, Pembroke Dock—Shipwright's Apprentice.
61—Thomas Wood Chapman, Mechanics' Institution, Ipswich—Clerk of Inland Revenue.
64—Robert Scarlett, aged 21, M. I., Ipswich—Clerk.
83—Benjamin Raby, jun., aged 19, M.I., Bradford—A Mechanic.
84—Alfred Liversedge, aged 17, Mechanics' Institute, Bradford—Warehouseman.
86—Richard Moore, aged 18, M. I., Bradford—Music Seller.
114—Henry Varley, aged 25, M. I., Manchester—Porter
118—Samuel Davies, aged 28, Mechanics' Inst., Manchester—Clerk.
192—James Barber, aged 19, Society for the Acquirement of Useful Knowledge, Macclesfield—Assistant Master of Workhouse.
227—Henry Turner Gale, aged 20, Royal Polytechnic, London—Ironmonger.
238—Walter Snell, aged 19, Royal Polytechnic, London—Surveyor.
240—George Alfred Tillett, aged 19, Royal Polytechnic, London—Clerk.
261—William Taylor, aged 21, M. I., Milns Bridge (Yorks.)—Spinner.
274—Walter James Hepworth, aged 17, People's College, Sheffield—Clerk.
283—Conyers Kirby, aged 20, The Institute, Liverpool—Surveyor and Draughtsman.
292—John Laurie, aged 16, Coll. Inst., Liverpool.
294—Richard Daniel Petterson, aged 16, Coll. Inst., Liverpool—Clerk.
296—Samuel Cross, aged 16, Coll. Inst., Liverpool—Clerk.
302—William Parry, aged 21, Collegiate Institute, Liverpool—Clerk.
303—Richard Owens, aged 26, Coll. Inst., Liverpool—Joiner.
311—Thomas Eccleston Gibb, aged 19, Collegiate Institute, Liverpool—Brushmaker.
317—William Birkbeck, aged 20, Working Man's College, Halifax—Warehouseman.
319—James Spencer, aged 24, Working Man's College, Halifax—Porter.
326—Thomas Pindar, aged 22, Working Man's College, Halifax—Overlooker.
327—Edward Cockroft, aged 20, Working Men's College, Halifax—Stover.
331—James Carr Norcliffe, aged 24, Working Man's Coll., Halifax—Weaver.
344—David George Pearse, aged 21, M.I., Berkhampstead—Shovel Maker.
346—Heber Charles Jones, aged 18, Mechanics' Institution, Berkhampstead—Clerk.

351—William Albert Skinner, aged 18, Mechanics' Institute, Berhampstead—Bricklayer.
469—John Fretwell, aged 20, Crosby-hall, London—Clerk.
478—Edward Highton, aged 20, Crosby-hall, London—Clerk.
486—Henry Sharp, aged 23, Lit. Sci., and M. I., Windsor—Painter.

BOOK-KEEPING.

First Class Certificates (Excellence).

25—George Harrison, aged 21, Young Men's Christian Institute, Leeds—Book-keeper.
37—George Edward Skinner, aged 21, Lit. Inst., Lymington—Attorney's Clerk.
67—James Dickie, aged 19, London Mechanics' Institution—Clerk.
72—William Walton Snelling, aged 21, London Mechanics' Institution—Clerk.
206—Edwin James Kelly, aged 17, Useful Knowledge Society, Macclesfield.
217—James Dawling Bennett, aged 18, Royal Polytechnic, London—Gas Engineer.
248—John Leech, aged 16, M. I. Halifax—Clerk.
260—David Baxter, aged 21, M. I., Mossley (Yorks.)—Card-room hand.
290—Wilfred Johanning, aged 16, Coll. Inst., Liverpool—Clerk.
317—William Birkbeck, aged 20, Working Man's College, Halifax—Warehouseman.
336—John Stamford Walton, aged 19, M. I., Northallerton.
467—Robert Corney Harrison, aged 22, Crosby Hall, London—Clerk.
468—John Joseph Goldsmith, aged 19, Crosby Hall, London—Clerk.
474—Frederick William Potter, aged 18, Crosby Hall, London—Clerk.
492—Edward Eccles Manning, Society D. U. K., Greenwich—Clerk.
500—George Wood, aged 32, Crosby Hall, London—Clerk.

Second Class Certificates (Proficiency).

61—Thomas Wood Chapman, aged 28, M. I., Ipswich—Clerk Inland Revenue.
64—Robert Scarlett, aged 21, M. I., Ipswick—Clerk.
118—Samuel Davies, aged 28, M. I., Manchester—Clerk.
122—John Pogson, aged 26, M. I., Manchester—Clerk.
267—Carter Lenthall, aged 31, People's College, Sheffield—Warehouseman.
295—Daniel Charles Carmichael, aged 21, Coll. Inst., Liverpool—Book-keeper.
337—James Finis Mennell, aged 22, Inst., York—Confectioner.
487—John Cocking Fielden, aged 20, L.S. and M I., Blackburn—Book-keeper.

Third Class Certificates (Competency).

12—Thomas Pearson Tate, aged 21, L. and M.I., West Hartlepool—Clerk.
28—Samuel Woodhead, aged 31, M.I., Northowram—Book-keeper.
52—James Denton, aged 26, M.I., Leeds—Mason.
53—George Best, aged 24, M.I., Leeds—Book-keeper.
230—Alfred Holloway, aged 19, Royal Polytechnic, London—Clerk.
259—Joseph Howard, aged 22, M.I., Mossley—Drapers' Assistant.
340—John Robertson, aged 25, M.I., York—Porter.

ALGEBRA.

First Class Certificates (Excellence).

20—Alfred Pickard, aged 16, Young Men's Christian Inst., Leeds—A Mechanic.
29—George William Wicker, aged 18, Watt Inst., Portsea—Engineer.
362—Francis Stone Evans, aged 18, Athenæum, Bristol.

Second Class Certificates (Proficiency).

56—John Charles Froyne, aged 23, M.I., Pembroke Dock—Shipwright.
73—Daniel Leggatt, aged 30, London Mechanics' Institution—Law Clerk.
94—James Mills, junr., aged 20. M.I., Bradford—Warehouseman.
121—Talbot Hamilton, aged 17, M.I., Manchester—Engineer.
283—Conyers Kirby, aged 20, Coll. Inst., Liverpool—Surveyor.
474—Frederick William Potter, aged 18, Crosby-hall, London—Clerk.
501—Arthur James Atkinson, aged 18, R. Lit. and Sci. Inst., Brighton.

Third Class Certificates (Competency).

41—John Joseph Chapman, aged 16, Lit. and Mutual M. Inst., West Brompton—Clerk.
45—Joseph Albert Dear, aged 17, M.I., Wakefield—Draper.
49—William Sterne, aged 20, M.I., Holbeck—A Mechanic.
93—John Laycock, junr., aged 29, M.I., Bradford—Schoolmaster.
122—John Pogson, aged 26, M.I., Manchester—Clerk.
228—Samuel Dean Grimson, aged 17, Royal Polytechnic, London.
282—George Lander, aged 21, M.I., Glasgow—Mechanical Engineer.
317—William Birkbeck, aged 20, Working Man's Coll., Halifax—Warehouseman.
332—Richard Cockroft, aged 18, Working Man's Coll., Halifax—Warehouseman.
334—Henry Smith, aged 17, Working Man's Coll., Halifax—Finisher.
485—Richard George Frost, aged 21, Crosby-hall, London—Clerk.

GEOMETRY.

First Class Certificate (Excellence.)

16—William Wheater, aged 17, Young Men's Christ. Inst.—Land Surveyor.

Second Class Certificates (Proficiency.)

29—George William Wicker, aged 18, Watt Institute, Portsea—Engineer.
30—Thomas William Smith, aged 19, Watt Institute, Portsea—Engineer.
122—John Pogson, aged 26, M. I., Manchester—Clerk.
341—Henry Irwin Jenkinson, aged 19, Inst., York—Clerk.
362—Francis Stone Evans, Athenæum, Bristol.

Third Class Certificates (Competency.)

20—Alfred Pickard, aged 16, Young Men's Christian Inst., Leeds—A Mechanic.
94—James Mills, jun., aged 20, M. I., Bradford—Warehouseman.
110—Arthur Ashworth, aged 18, M. I., Manchester—Mechanic.
206—Edwin James Kelly, aged 17, Useful Knowledge Soc.—Macclesfield.
472—Thomas Roberts, aged 20, Crosby-hall, London—Printer.

MENSURATION.

First Class Certificate (Excellence).

29—George William Wicker, aged 18, Watt Institute, Portsea—Engineer.

Second Class Certificates (Proficiency).

20—Alfred Pickard, aged 16, Young Men's Christian Inst., Leeds—Mechanic.
22—Joseph Hough, aged 20, Young Men's Christian Inst., Leeds—Mechanic.
56—John Charles Froyne, aged 23, M. I., Pembroke Dock—Shipwright.
94—James Mills, junr., aged 20, M. I., Bradford—Warehouseman.
110—Arthur Ashworth, aged 18, M. I., Manchester—Mechanic.
111—Alfred Wadsworth, aged 16, M. I., Manchester—Engineer.
472—Thomas Roberts, aged 20, Crosby Hall, London—Printer.
474—Frederick William Potter, aged 18, Crosby Hall, London—Clerk.

Third Class Certificates (Competency.)

5—Robert Leyland, aged 24, M.I., Wigan—Chain-maker.
28—Samuel Woodhead, aged 31, M. I., Northowram—Book-keeper.
30—Thomas William Smith, aged 19, Watt Institute, Portsea—Engineer.
43—Henry Logan, aged 17, M.I., Wakefield—Iron Moulder.
57—William Clark, aged 32, M.I., Pembroke Dock—Shipwright.
78—Thomas Bedford, aged 28, M.I., Selby, Schoolmaster.
122—John Pogson, aged 26, M.I., Manchester—Clerk.
227—Henry Turner Gale, aged 20, Royal Polytechnic, London—Ironmonger.
240—George Alfred Tillett, aged 19, Royal Polytechnic, London—Clerk.
282—George Lauder, aged 21, M.I.,Glasgow—Mechanical Engineer.
303—Richard Owens, aged 26, Coll. Inst., Liverpool—Joiner.
478—Edward Highton, aged 20, Crosby Hall, London—Clerk.
487—John Cocking Fielden, aged 20, L.S. and M.Inst., Blackburn—Book-keeper.

TRIGONOMETRY.

First Class Certificates (Excellence).

None.

Second Class Certificates (Proficiency).

20—Alfred Pickard, aged 16, Young Mens Christian Inst., Leeds—A Mechanic.
30—Thomas William Smith, aged 19, Watt Inst., Portsea—Engineer.
56—John Charles Froyne, aged 23, M. I. Pembroke Dock—Shipwright.
94—James Mills, junr., aged 20, M.I. Bradford—Warehouseman.
362—Francis Stone Evans, aged 18, Athenæum, Bristol.

Third Class Certificates (Competency).

29—George William Wicker, aged 18, Watt Inst., Portsea—Engineer.
283—Conyers Kirby, aged 20, Coll. Inst., Liverpool—Surveyor.
341—Henry Irwin Jenkinson, aged 19, Inst. Pop. Sci., &c., York—Clerk.

CONIC SECTIONS.

First Class Certificate (Excellence).

362—Francis Stone Evans, aged 18, Athenæum, Bristol.

Second Class Certificates (Proficiency).

20—Alfred Pickard, aged 16, Young Men's Christian Inst., Leeds—A Mechanic.
22—Joseph Hough, aged 20, Young Men's Christian Inst., Leeds—A Mechanic.
472—Thomas Roberts, aged 20, Crosby Hall, London—Printer.

Third Class Certificates (Competency).

56—John Charles Froyne, aged 23, M. I., Pembroke Dock—Shipwright.
94—James Mills, jun., aged 20, M. I., Bradford—Warehouseman.
283—Conyers Kirby, aged 20, Collegiate Inst., Liverpool—Surveyor.

NAVIGATION AND NAUTICAL ASTRONOMY.

First Class Certificates (Excellence).

(None.)

Second Class Certificates (Proficiency).

(None.)

Third Class Certificate (Competency).

22—Joseph Hough, aged 20, Young Men's Christ. Inst., Leeds—A Mechanic.

STATICS, DYNAMICS, AND HYDROSTATICS.

First Class Certificates (Excellence.)

None.

Second Class Certificates (Proficiency).

29—George William Wicker, aged 18, Watt Inst., Portsea—Engineer.

Third Class Certificates (Competency).

22—Joseph Hough, aged 20, Young Men's Christian Inst., Leeds—A Mechanic.
30—Thomas William Smith, aged 19, Watt Institute, Portsea—Engineer.
56—John Charles Froyne, aged 23, M.I., Pembroke Dock—Shipwright.
94—James Mills, junr., aged 20, M.I., Bradford—Warehouseman.
128—Edward Jacob, aged 18, M.I., Manchester—Engineer.
249—Joseph James Coleman, aged 19, M.I., Halifax—Chemist and Druggist.
282—George Lauder, aged 21, M.I., Glasgow—Mechanical Engineer.
336—John Stamford Walton, aged 19, M.I., Northallerton.

PRACTICAL MECHANICS.

First Class Certificates (Excellence).

None.

Second Class Certificates (Proficiency).

29—George William Wicker, aged 18, Watt Institute, Portsea—Engineer.
36—Conrad Horz, aged 19, Church of England Institute, Newcastle-on-Tyne—Gentleman's Servant.

Third Class Certificates (Competency).

18—Richard Henry Butterworth, aged 18, Young Men's Christian Inst., Leeds—A Mechanic.
336—John Stamford Walton, junr., aged 19, M.I., Northallerton.

MAGNETISM, ELECTRICITY, AND HEAT.

First Class Certificates (Excellence).

None.

Second Class Certificates (Proficiency).

232—Francis Henry Keeble, aged 18, R. Polytechnic, London—Marqueterie Cutter.
249—Joseph James Coleman, aged 19, M.I. Halifax—Chemist and Druggist.

Third Class Certificates (Competency).

336—John Stamford Walton, junr., aged 19, M.I. Northallerton.

ASTRONOMY.

First Class Certificates (Excellence).

None.

Second Class Certificates (Proficiency).

20—Alfred Pickard, aged 16, Young Men's Christian Institute, Leeds—A Mechanic.
22—Joseph Hough, aged 20, Young Men's Christian Institute, Leeds—A Mechanic.
56—John Charles Froyne, aged 23, M.I. Pembroke Dock—Shipwright.

Third Class Certificates (Competency).

None.

CHEMISTRY.

First Class Certificates (Excellence.)

237—Frederick William Rudler, aged 17, R. Polytechnic, London—Clerk.
496—George Warington, aged 17, Crosby-hall, London—Works in a chemical laboratory.

Second Class Certificates (Proficiency.)

66—Thomas Shinn, aged 16, London Mechanics' Inst.—Clerk.
320—William Carr Hebden, aged 18, Working Man's Coll. Halifax—Chemist and Druggist.

Third Class Certificates (Competency.)

2—John Parkinson Atkinson, aged 19, M.I., Louth—Chemist and Druggist.
3—John Burgess, aged 19, M.I., Louth—Printer.
128—Edward Jacob, aged 18, M.I., Manchester—Engineer.
232—Francis Henry Keeble, aged 18, Royal Polytechnic—Marqueterie Cutter.
247—John Morton Barbour, aged 27, M.I., Halifax—Clerk.
269—William Collier, aged 16, People's College, Sheffield—Chemist and Druggist.

ANIMAL PHYSIOLOGY.

First Class Certificates (Excellence).

(None.)

Second Class Certificates (Proficiency).

14—Oswald Brigg, aged 21, Young Men's Christian Inst., Leeds—Clerk.
249—Joseph James Coleman, aged 19, M. I., Halifax—Chemist and Druggist.

Third Class Certificate (Competency).

(None.)

BOTANY.

First Class Certificate (Excellence).

496—George Warington, aged 17, Crosby Hall, London—Worker in a chemical laboratory.

Second Class Certificates (Proficiency).

(None.)

Third Class Certificate (Competency).

263—Edward Birks, aged 29, People's Coll., Sheffield—Bank Cashier.

POLITICAL AND SOCIAL ECONOMY.

First Class Certificates (Excellence).

483—Robert James White, aged 20, Crosby-hall, London—Clerk.

Second Class Certificates (Proficiency).

None.

Third Class Certificate (Competency).

487—John Cocking Fielden, aged 20, L.S. and M.I., Blackburn—Book-keeper.

DESCRIPTIVE GEOGRAPHY.

First Class Certificates (Excellence).

32—Richard Harper Stretch, aged 20, M.I., Banbury—Draper.
53—George Best, aged 24, M.I., Leeds—Book-keeper.
67—James Dickie, aged 19, London Mech. Inst.—Clerk.
72—William Walton Snelling, aged 21, London Mech. Inst.—Clerk.
311—Thomas Eccleston Gibb, aged 19, Coll. Inst., Liverpool—Brushmaker.

Second Class Certificates (Proficiency).

12—Thomas Pearson Tate, aged 21, L. and M.I., West Hartlepool—Clerk.
31—Joseph Flashman, aged 18, Athenæum, Warminster—Auctioneer.
33—Thomas Lamb, aged 22, M. I., Banbury—Confectioner.
39—Walter Wellsman, aged 24, Lit. and Mutual Improvement Inst., West Brompton—Clerk.
50—Linley Oldroyd, aged 16, M.I., Leeds.
58—Joseph Evans, aged 27, M.I., Pembroke Dock—Shipwright.
90—Joseph Harrison, aged 16, M.I., Bradford—Warehouse Boy.
235—James Purrott, aged 23, R. Polytechnic, London—Clerk.
335—John Holmes, aged 31, Working Man's College, Halifax—Finisher.
493—Edwin Sloman Rous, aged 19, Improvement Inst., Lewes—School-teacher.

Third Class Certificates (Competency).

8—Kenneth Mackenzie, aged 16, M.I., Wigan—Mining Engineer.
9—James Platt, aged 20, M.I., Wigan—Lawyer's Clerk.
35—John Stanger, aged 27, Church of England Inst., Newcastle-on-Tyne—Butler.
51—Matthew Graham, aged 18, M.I., Settle—Joiner.
59—John Mumford, aged 19, M.I., Pembroke Dock, Shipwright.
132—Edwin Sloper, aged 17, Literary Inst., Salisbury—Bank Cashier.
365—Thomas Harper Heald, aged 32, London Domestic Mission, Cripplegate—House Decorator.
486—Henry Sharp, aged 23, Lit. Sci. and M.I., Windsor—Painter.

PHYSICAL GEOGRAPHY INCLUDING GEOLOGY.

(First Class Certificate (Excellence.)

32—Richard Harper Stretch, aged 20, M.I., Banbury—Draper.

Second Class Certificates (Proficiency.)

12—Thomas Pearson Tate, aged 21, Lit. and M.I., West Hartlepool—Clerk.
33—Thomas Lamb, aged 22, M.I., Banbury—Confectioner.
39—Walter Wellsman, aged 24, Lit and Mutual Improvement Assoc. West Brompton—Clerk.
90—Joseph Harrison, aged 16, M.I. Bradford—Warehouseman.
311—Thomas Eccleston Gibb, aged 19, Coll. Inst., Liverpool—Brushmaker.

Third Class Certificates (Competency.)

35—John Stanger, aged 27, Church of England Institute, Newcastle-on-Tyne—Butler.
132—Edwin Sloper, aged 17, Lit. Inst., Salisbury—Bank Cashier.
365—Thomas Harper Heald, aged 32, London Domestic Mission, Cripplegate—House Decorater.
493—Edwin Slowman Rous, aged 19, Improvement Inst., Lewes—School Teacher.

ENGLISH HISTORY.

First Class Certificate (Excellence).

53—George Best, aged 24, M. I., Leeds—Book-keeper.

Second Class Certificates (Proficiency).

37—George Edward Skinner, aged 21, Lit. Inst., Lymington—Attorney's Clerk.
55—William Knapton, aged 29, M. I., Leeds—Mason.
64—Robert Scarlett, aged 21, M. I., Ipswich—Clerk.
88—Joseph Seed Roberts, aged 17, M. I., Bradford—Cabinet Maker.
89—William Hay, aged 17, M. I., Bradford—Printer.
252—William T. Dewhirst, aged 16, M. I., Halifax—Telegraph Clerk.
311—Thomas Eccleston Gibb, aged 19, Coll. Inst., Liverpool—Brush Maker.
319—James Spencer, aged 24, Working Man's Coll., Halifax—Porter.
365—Thomas Harper Heald, aged 32, London Domestic Mission, Cripplegate—House Decorator.

Third Class Certificates (Competency).

1—William Williams, aged 20, M. I., Louth—
4—John Roney, aged 16, M. I., Louth—Attorney's Clerk.
8—Kenneth Mackenzie, aged 16, M. I., Wigan—Mining Engineer.
50—Linley Oldroyd, aged 16, M. I., Leeds—
261—William Taylor, aged 21, M.I., Milnes-bridge—Spinner.
268—Thomas Dresser, age 24, People's Coll. Sheffield—Post-office Clerk.
318—John Walker, aged 18, Working Man's College, Halifax—Woollen Spinner.
325—John Hollinrake, aged 19, Working Man's College, Halifax—Carder.
476—James David Gellen, aged 18, Crosby-hall, London—Clerk.
486—Henry Sharp, aged 23, Lit. Sci. and M.I., Windsor—Painter.

ENGLISH LITERATURE.

First Class Certificates (Excellence).

258—Joseph Fox, aged 21, M.I., Halifax—Timber Merchant.
263—Edward Birks, aged 29, People's Coll., Sheffield—Bank Cashier.
265—Joshua Hopkins Davy, aged 31, People's Coll., Sheffield—Grocer.

Second Class Certificates (Proficiency).

17—William Henry Tetley, aged 19, Young Men's Christian Inst., Leeds—Bookseller.
60—Henry Best, aged 20, M.I., Ipswich—Clerk.
69—Francis Lynch, aged 21, London Mechanics' Institution—Compositor and Reader.
92—William Harrison, aged 19, M.I., Bradford—Compositor.
259—Joseph Howard, aged 22, M.I., Mossley—Draper's Assistant.

THIRD CLASS CERTIFICATES. (COMPETENCY.)

21—Charles Robinson, aged 21, Young Men's Christian Inst., Leeds—Warehouseman.
23—Charles Cowell, aged 18, Young Men's Christian Inst., Leeds—Compositor.
25—George Harrison, aged 21, Young Men's Christian Inst., Leeds—Book-keeper.
54—Charles Thomas Barnes, aged 16, M.I., Leeds—Clerk.
61—Thomas Wood Chapman, aged 28, M.I., Ipswich—Clerk, Inland Revenue.
63—Gordon Dothie, aged 19, M.I., Ipswich—Tobacconist.
228—Samuel Dean Grimson, aged 17, Royal Polytechnic.
266—John Lister, aged 29, People's College, Sheffield—Butcher.
291—Malcolm Guthrie, aged 21, Coll. Inst., Liverpool—Book-keeper.
319—James Spencer, aged 24, Working Man's College, Halifax—Porter.
335—John Holmes, aged 31, Working Man's College, Halifax—Finisher.
487—John Cocking Fielden, aged 23, L. S., and M.I., Blackburn—Book-keeper.

LATIN AND ROMAN HISTORY.

FIRST CLASS CERPIFICATE (EXCELLENCE).

264—William Thomas Hutchinson, aged 28, People's Coll., Sheffield—Butcher.

SECOND CLASS CERTIFICATES (PROFICIENCY).

60—Henry Best, aged 20, M.I., Ipswich—Clerk.
472—Thomas Roberts, aged 20, Crosby-hall, London—Printer.

THIRD CLASS CERTIFICATE (COMPETENCY).

501—Arthur James Atkinson, aged 18, R. Lit. and Sci. Inst., Brighton.

LATIN (ALONE).

FIRST CLASS CERTIFICATE (EXCELLENCE).

473—James Brady, aged 19, Crosby-hall, London—Carpenter.

SECOND CLASS CERTIFICATE (COMPETENCY).

69—Francis Lynch, aged 21, London Mech. Inst.—Compositor and Reader.

FRENCH.

FIRST CLASS CERTIFICATE (EXCELLENCE).

None.

SECOND CLASS CERTIFICATES (PROFICIENCY).

54—Charles Thomas Barnes, aged 16, M.I., Leeds—Clerk.
67—James Dickie, aged 19, London Mechanics' Institution—Clerk.
91—William Wilcock, aged 25, M.I., Bradford—Clerk.
244—Richard McCully, aged 27, Messrs. Chances' Reading-room, &c., Birmingham—Clerk.
250—William Henry Knowles, aged 27, M.I., Halifax—Card Maker.
283—Conyers Kirby, aged 20, Coll. Inst., Liverpool—Surveyor.
353—Eliza Hall, aged 28, Athenæum, Bristol.
355—Elizabeth McArthur, aged 18, Athenæum, Bristol.
362—Francis Stone Evans, aged 18, Athenæum, Bristol.
501—Arthur James Atkinson, aged 18, R. Lit. and Scientific Inst., Brighton.

THIRD CLASS CERTIFICATES (COMPETENCY).

18—Richard Henry Butterworth, aged 18, Young Men's Christian Institute, Leeds—A Mechanic.
37—George Edward Skinner, aged 21, Literary Institution, Lymington—Attorney's Clerk.
69—Francis Lynch, aged 21, London Mechanics' Institution—Compositor and Reader.
106—Maurice Bibby, aged 20, M.I. Manchester—Clerk.
194—Sarah Ellen Lean, aged 37, M.I. Macclesfield—Governess.
228—Samuel Dean Grimson, aged 17, R. Polytechnic, London.
242—Walter Coates, aged 23, R. Polytechnic, London—Clerk.
267—Carter Lenthall, aged 31, People's College, Sheffield—Warehouseman.
356—Alice Davies, aged 18, Athenæum, Bristol.
357—John Morris Harris, aged 19, Athenæum, Bristol—Clerk.
358—Margaret Lydia Lovell, aged 17, Athenæum, Bristol.
479—Edward Phillip Plowman, aged 18, Crosby Hall, London—Clerk.
481—John Sharland Dyer, aged 21, Crosby Hall, London—Draper.
497—William Gilmore Reid, aged 28, Crosby Hall. London—Compositor.
498—Henry Legg, aged 21, Crosby Hall, London—Butcher.
500—George Wood, aged 32, Crosby Hall, London—Clerk.

GERMAN.

FIRST CLASS CERTIFICATES (EXCELLENCE).

None.

Second Class Certificates (Proficiency).

62—James Denton, aged 26, M.I., Leeds—Mason.

Third Class Certificates (Competency).

42—Joseph Parker Marriott, aged 20, M.I., Wakefield—Overlooker.
118—Samuel Davies, aged 28, M.I., Manchester—Clerk.
244—Richard McCully, aged 27, Messrs. Chances' Reading Room, &c., Birmingham—Clerk.
471—James Brignall, aged 25, Crosby Hall, London—Accountant.

FREE-HAND DRAWING.

First Class Certificates. (Excellence.)

(None.)

Second Class Certificates (Proficiency).

95—John Sowden, aged 19, M.I., Bradford—Builder.
98—William Henry Spurr, aged 20, M.I., Bradford—Cabinet-maker.
99—Abner Rhodes, aged 22, M.I., Bradford—Mason.
229—Alfred Healey, aged 19, Royal Polytechnic—Joiner.
280—Edwin Guthrie, aged 16, Coll. Inst., Liverpool—Clerk.
361—James Craik, aged 17, Athenæum, Bristol—Surveyor.
363—Thomas Henry Yabbicorn, aged 16, Athenæum, Bristol.
364—William Milthorp Arundale, aged 16, M.I., Bradford, Engraver.

Third Class Certificates (Competency.)

31—Joseph Flashman, aged 18, Athenæum, Warminster—Auctioneer.
34—William Tate Wilson, aged 20, Church of England Inst., Newcastle-upon-Tyne—Painter and glazier.
74—John Denby Cuttle, aged 35, M.I., Selby—Schoolmaster.
96—George Andrew Jones, aged 19, M.I., Bradford—Warehouseman.
97—James Cooper, aged 22, M. I., Bradford—In a Warehouse.
191—Marshall McKnight, aged 18, U. K. Society, Macclesfield—Clerk.
206—Edwin James Kelly, aged 17, U. K. Society, Macclesfield.
224—William Edwards, aged 17, Royal Polytechnic, London—Joiner.
227—Henry Turner Gale, aged 20, Royal Polytechnic, London—Ironmonger.
304—William Pownall Green, aged 16, Coll. Inst., Liverpool—

MECHANICAL OR GEOMETRICAL DRAWING.

First Class Certificates (Excellence).

(None.)

Second Class Certificates (Proficiency.)

110—Arthur Ashworth, aged 18, M.I., Manchester—A Mechanic.
293—Robert Gordon, aged 17, Coll. Inst., Liverpool—Millwright.

Third Class Certificates (Competency.)

10—John Barnard Stevens, aged 26. M.I., Wigan—Mechanical Draughtsman.
95—John Sowden, aged 19, M.I., Bradford—Builder.
103—Charles George Chapman, aged 18, M.I., Manchester—Engineer.
111—Alfred Wadsworth, aged 16, M.I., Manchester—Engineer.
282—George Lauder, aged 21, M.I., Glasgow—Mechanical Engineer.
303—Richard Owens, aged 26, Coll. Inst., Liverpool—Joiner.

BRITISH HONDURAS.

(*Concluded from page* 471.)

Mr. Buchanan says, with reference to the treaty of 1786, "so far from this treaty being put an end to by the war, its continued existence in 1817 and 1819 was recognised by acts of the British Parliament. These declare in so many words that "Belize" was not within the territory and dominions of his Majesty, "but was merely a settlement for certain purposes in the possession and under the protection of his Majesty."

It is true that the statutes referred to by Mr. Buchanan are somewhat cautiously, and in some respects, perhaps, rather ambiguously worded, but I deny the correctness of the conclusion at which Mr. Buchanan arrives, that "they recognise the continued existence of the treaties of 1783 and 1786."

"Statutes consist of two parts, the words and the sense; and it is the office of an expositor to put such a sense upon the words of the statute as is agreeable to equity and right reason."—[Plowd. 363, 465.]

Lord Coke says, "It is the most natural and genuine exposition of a statute, to construe one part of the statute by another part of the same statute, for that best expresseth the meaning of the makers."—1st Inst., 381.

Adopting these rules of construction, let us now apply our minds to the statutes in question.

The 57th of Geo. 3rd, c. 53, says, "All murders and manslaughters committed, or that shall be committed, on land at the settlement in the Bay of Honduras, by any person or persons residing or being within the said settlements" (not excepting even the subjects of the King of Spain), "And all murders and manslaughters committed, or that shall be committed in the Islands of New Zealand and Otaheite, or within any other islands, countries, or places, not within his Majesty's dominions, nor subject to any other European state, or power, &c., &c., shall and may be tried, adjudged, and punished," &c.

Now, there are two things to be noted in the words above quoted. 1st. That all murders and manslaughters, committed by any person, or persons, residing, or being in Honduras, may be tried, &c. If it had been the intention of that act to recognise the treaties of 1783 and 1786, which recognition would have amounted to an acknowledgment of the sovereignty of Spain,—the expression would not have been, by *any* person, which term necessarily includes Spaniards as well as Englishmen,—but the expression would have been—All murders, &c., committed by British subjects residing in Honduras,—or by any person, or persons, not being subjects of the King of Spain. I repeat that that must necessarily have been so,—for the 7th article of the treaty of 1786 prohibits "the meditating any more extensive settlements, or the formation of any system of government, either military or civil, further than such regulation as their Britannic and Catholic Majesties may hereafter judge proper to establish, for maintaining peace and good order amongst their respective subjects."

2nd. The words are, "Committed on land at the settlement in the Bay of Honduras, &c., or within any other islands, countries, or places not within his Majesty's dominions, nor subject to any other European state or power." If, then, a certain portion of the statute, from motives which I do not pretend to inquire into, makes use of words which upon the face of them, and without further investigation, and a consideration of the drift and intention of the act taken as a whole, and a collation of one part of the statute with another part, which parts, when not so compared, resemble the distributed type of the printer, which can convey no ideas, —would seem to favour the notion that Honduras was not deemed to be a dominion of the British crown, the same statute also, in so many words, distinctly declares that it is not a dominion of Spain, the words being, "Nor subject to any European power or state."

Well, then, I think it cannot with any show of reason be urged that the 57th of Geo. 3rd, c. 53, "recognises the continued existence of the treaties of 1783 and 1786."

Let us now see if the 59th of Geo. 3rd, c. 44., the other imperial statute alluded to by Mr. Buchanan, has that effect. That statute, after reciting the 57th of Geo. 3rd, c. 53, says, "And whereas doubts have arisen whether in the said settlements in the Bay of Honduras, there be a fort or factory to which a commission may issue for the trial of offences under the said last mentioned act, and whereas by reason of such doubts, and the great delay and difficulty of removing offenders in Honduras for trial to England, or to any of his Majesty's islands, plantations, colonies, dominions, forts, or factories, such crimes do often times escape unpunished; for remedy whereof be it enacted, by the King's most excellent Majesty, &c., that from and after the passing of this act, all murders, manslaughters, rapes, robberies, and burglaries, committed, or that shall be committed on land, at the said settlement in the Bay of Honduras, may be inquired of, tried, heard and determined, and adjudged, within the said settlement in the Bay of Honduras, under, or by virtue of the King's commission, or commissions under the great seal of Great Britain, to be directed to any such four or more discreet persons, as the Lord Chancellor of Great Britain, &c., for the time being, shall from time to time think fit to appoint, &c. And all persons convicted of either of the said offences so to be tried, &c., shall be subject and liable to, and shall suffer all such and the like pains, penalties, or forfeitures as by any law, or laws, now in force, persons convicted of the same respectively would be subject and liable to in case the same were respectively enquired of, tried, heard, determined, and adjudged, within any of his Majesty's islands, &c." Whenever a statute expresses that doubts have existed whether such and such things might be done, and it declares that they may, and enacts that they shall be done, then is there an end to all such doubts.

Before the passing of the 59 Geo. III., people doubted whether Honduras was so far a possession of his Majesty as that a commission might issue to it for the trial of certain offences. That statute put an end to the doubt, by enacting that a commission should issue for that purpose. The statute enacts that all murders, manslaughters, &c., may be tried, by whomsoever committed, and that all persons convicted of the said offences would be subject to the same penalties, &c., as persons convicted of the same offences would be subject and liable to in case the same were respectively enquired of, tried, &c., in any of his Majesty's dominions."

This statute may, according to American rules of construction, recognise the treaties with Spain, which strictly prohibit any civil government, any Courts of Justice, or any act whatsoever which shall be inconsistent "with the entire preservation of the right of the Spanish sovereignty over the country." But it would require an Englishman to live for a pretty considerable time in the States, and to eat bushels of American oysters, a large amount of soft crabs, whole flocks of canvass-back ducks, and to drink oceans of dog's-nose, mint julep, sherry cobbler, and other classical beverages, in which the votaries of Bacchus in that country rejoice, before such a mutation would take place in his cerebellum as would enable him to take that Buchananian view.

There cannot be a more distinct assertion of international right than the erection of judicial tribunals, before which all persons, to whatever nation they may belong, to whomsoever their allegiance may be due, may be tried alike, according to the laws of the country which claims and exercises those rights. Such a judicial tribunal was created by the 59 Geo. III. c. 44, and before it subjects of the crown of Spain may be tried for murder, and, if convicted, may be sentenced to be hanged.

Vattel says, "the empire united to the domain, establishes the jurisdiction of the nation in its territories, or the country that belongs to it. It is that, or its sovereign, who is to exercise justice in all the places under his obedience, to take cognizance of the crimes committed, and the differences that arise in the country."

Dr. Story, an American jurist, of great and deserved repute, and whose authority Mr. Buchanan must respect, says, "Boullenois has laid down the following among his general principles. He says, "He, or those who have the sovereign authority, have the sole right of making laws, and those laws ought to be executed within the sovereignty where they are known in the prescribed manner. Another maxim or proposition is, that no state or nation can, by its laws, directly affect or bind property out of its own territory, or bind persons not resident therein, whether they are natural born subjects or others. This is a natural consequence of the first proposition, for it would be wholly incompatible with the equality and exclusiveness of the sovereignty of all nations, that any one nation should be at liberty to regulate either persons or things not within its own territory. It would be equivalent to a declaration that the sovereignty over a territory was never exclusive in any nation, but only concurrent with that of all other nations; that each should legislate for all, and none for itself; and that all might establish rules which none were bound to obey. The absurd results from such a state of things need not be dwelt upon. Accordingly, Rodenburgh has significantly said, that no sovereign has a right to give the law beyond his own dominions, and if he attempts it he may be lawfully refused obedience; for wherever the foundation of laws fails, then their force and jurisdiction fail also."

Would Mr. Buchanan, if he were to condescend to read this paper, now say that the 59 Geo. III. c. 44 recognised the treaties of 1783 and 1786?

But the Commissioners to be appointed under that statute were to receive their authority under the Great Seal of Great Britain. I think no one will attempt to controvert this proposition, that the Great Seal cannot operate in any place which is not under the dominion of the British crown. In the case of the Earl of Derby v.

the Duke of Athol, 2 Ves. Sen. 337-357, Lord Hardwicke, in delivering judgment, said, "Though the Isle of Man be granted under the Great Seal of England, English law does not necessarily prevail in it. The Great Seal of England operates in all territories subject to the crown of England, whatever their laws may be. The King can grant, under the Great Seal of England, lands in Ireland, in the plantations, and in Guernsey and Jersey, because they are all parts of his crown."

But by the 59 Geo. III., the king does more than grant lands under the Great Seal, he grants a power of life and death over the subjects of the Spanish Crown. I think I need say no more to prove the absurdity of the proposition that the 59 Geo. III., c. 44, recognises the treaties with Spain of 1783 and 1786.

Mr. Buchanan next observes, "In addition to these Acts of Parliament, it is proper here to report that so late as 1826, Great Britain has, by her treaty with Mexico, acknowledged the continued existence and binding force of the treaty of 1786."

This is a very strange doctrine, that a treaty with one country should be held to give vitality and force to an extinct treaty with another. Supposing we had, in our treaty with Mexico, acknowledged the existence of certain treaties with Spain, what efficacy would such an acknowledgment have as long as it was not made to Spain herself, towards whom we were committing acts and holding language in respect to the territories to which the treaties referred totally inconsistent with such an acknowledgment? But we made no such acknowledgment to Mexico. The following is the article in the treaty with Mexico to which Mr. Buchanan alludes:—

"The subjects of his Britannic Majesty shall on no account or pretext be disturbed or molested in the peaceable possession and exercise of whatever rights, privileges, or immunities they have at any time enjoyed within the limits described and laid down in a convention signed between his said Majesty and the King of Spain, on the 14th of July, 1786, whether such rights, privileges, and immunities shall be derived from the stipulations of the said convention, or from any other concession which may at any time have been made by the King of Spain or his predecessors to British subjects and settlers residing and following their lawful occupations within the limits aforesaid, the two contracting parties reserving, however, for some more fitting opportunity the further arrangements on this article."

Now, the meaning of this article must be obvious to all persons whose bodies are not another mode (as Locke would have called it) or state of existence, of soft crabs and canvass-back ducks. The object of the article is that British subjects shall not be disturbed and molested in the peaceable possession and exercise of their rights. Where? "Within the limits described and laid down in the convention signed between his Britannic Majesty and the King of Spain, on the 14th of July, 1786."

What rights?

"Whatever rights, privileges, and immunities they have at any time enjoyed, whether such rights shall have been derived from the stipulations of the said convention, or from any other concession which may at any time have been made by the King of Spain or his predecessors."

Thus it will be readily perceived that the treaty with Mexico specifies, as to the locality in which British subjects are to possess and exercise their rights, that which is described in the convention of 1786, but in defining those rights it does not confine itself to that treaty, for it says, whatever rights which have at any time enjoyed from it, or any other concession which may at any time have been made by the King of Spain or his predecessors. Well, then, was any other concession ever, at any time, made by the King of Spain or his predecessors? Yes. In the year 1690, we have seen that a predecessor of the King of Spain, viz., Charles II., agreed to a treaty with Great Britain, in which there was the following article:—

"Moreover, it is agreed that the most Serene King of Great Britain, his heirs and successors, shall have, hold, keep, and enjoy for ever, with plenary right of sovereignty, dominion, possession, and propriety, all those lands, regions, islands, colonies, and places whatsoever, being or situated in the West Indies or in any part of America, which the said King of Great Britain or his subjects do at present hold and possess, &c."

I think, then, it is sufficiently clear that the treaty with Mexico does not acknowledge the continued existence of the convention of 1786, seeing that it stipulates that the King of Great of Britain shall have "plenary right of sovereignty, dominion, possession, and propriety," and that it only refers to the said convention to ascertain limits within which that "sovereignty and dominion" shall be possessed and exercised. What are those limits, and what are the actual boundaries at the present time of British Honduras to the north of the Belize River, and westward from the sea? These are very important questions, and they must ere long be definitively settled. I shall submit my view of the subject.

But first let me most emphatically repudiate the doctrine, that an agreement or compact with one country can be enforced by another country. If a treaty be violated, it is for parties to that treaty alone who have suffered wrong to resent that violation. Another country, not a party to the treaty (under ordinary circumstances), has no right to interfere. I, of course, make all exception in favour of our ally.

Our treaty with Mexico, previously referred to, without pretending to revive or acknowledge the existence of, as I have already said, the treaties with Spain of 1783 and 1786, but merely taking them as guides for the purpose of defining the boundaries of that portion of British Honduras which was conterminous with that country—I mean Mexico—says, "The subjects of his Britannic Majesty shall on no account or pretext whatsoever be disturbed or molested in the peaceable possession, &c., within the limits described and laid down in a convention signed between his said Majesty and the King of Spain on the 14th of July, 1786. Now, the treaty of 1786 does not describe those limits, but it refers to the treaty of 1783. Well, I think I might dwell upon this circumstance, of no little weight, but "not to put too fine an edge upon it," as the little law-stationer in "Bleak House" would have said, I will magnanimously waive that point for the present, only promising to take it up in good earnest, if our American friends should recalcitrate.

I apprehend there are three modes of treating this question.

1. At the time when the treaty with Mexico was negotiated, mahogany and logwood were the only articles of commerce which Honduras was thought capable of producing. The cultivation of the soil was not thought of. It was also believed, although that belief was founded upon an absence of correct information, that all the mahogany and logwood were cut out of the country adjacent to the Hondo, and approximating to the western side. It was also erroneously supposed that the British settlers were not in possession of any of the lands situated to the north-west of the line referred to in the treaty with Mexico. Now the fact is, that the mahogany and logwood were not nearly cut out of those localities. The logwood could not be, for that tree when cut down grows again as luxuriantly as ever. The mahogany tree, like the Scotch fir, never sends forth new shoots, but rots in the ground. This fact proves the ignorance of those who concluded the treaty, when they say, "As it is generally allowed that the woods and forests are preserved, and even multiply by regular and methodical cuttings, the English shall observe this maxim as far as possible."

Knowing that the logwood tree grows again, and imagining that the mahogany tree also did, it was very odd, to say the least of it, that they should come to the conclusion that both those woods were cut out of the country.

It was also a fact that the British settlers had been in undisturbed possession of lands, very far beyond the line referred to, ever since 1798. In that year, the settlers, having repulsed the Spanish invaders, not only regained possession of the country within the supposed limits of the treaties, of which they had from time to time been dispossessed by the encroachments of the Spaniards, but they very laudably helped themselves, by way of interest, to a large tract of country beyond those limits, of which tract they have been in as peaceable and complete possession as of any other portion of British Honduras until the present day, and to which the British Crown has as good and valid a title as to the rest of the country. The treaty with Mexico was therefore concluded on the part of Great Britain under an entire misconception of existing circumstances, in ignorance of the real facts, and in consequence of misrepresentations made by Mexico. This, I apprehend, invalidates the contract. Great Britain agrees to so and so, assuming so and so to be the facts. But Great Britain was deceived—so and so were not the facts. The agreement, therefore, is void. M. Pothier says, "Error is the greatest defect that can occur in a compact, for agreements can only be framed by the consent of the parties, and there can be no consent where the parties are in an error respecting the object of their agreement. * * * * Error annuls the agreement not only when it affects the identity of the subject, but also when it affects that quality of the subject which the parties have principally in contemplation, and which makes the substance of it. Therefore, if with the intention of buying from you a pair of silver candlesticks, I buy a pair which was only plated, though you have no intention of deceiving me, being in equal error yourself, the agreement will be void, because my error destroys my consent, for my intention was to buy a pair of silver candlesticks; those which you offer for sale being plated, it cannot be said that they are what I intended to buy. This is decided by Julian in a similar case, when he says, *si æs pro auro veneat non valet*. [Pothier, "On Obligation," v. i., p. 13.]

Precisely in this situation do we stand. The British Government never intended, by the treaty above quoted, to give up the undoubted dominion of the crown; they never intended to give up lands which were extremely valuable; but, being under the erroneous impression that the lands in question were of no value, and also being ignorant of the fact that the country had been in the possession of British subjects for a great number of years, without any pretext or remonstrance having been made, they agreed to the article above quoted. These facts, according to the doctrine laid down by Pothier and all other writers upon such subjects, completely nullify the contract. But, as though Mr. Huskisson and Mr. Morier had had some inkling of the real state of affairs, the article concludes with these words:—

"The two contracting parties reserving, however, for some more fitting opportunity, the further arrangements on this article."

The article, therefore, was of a temporary and provisional nature, and subject to be altered and revised at a future period, if it should hereafter be discovered that either or both parties had proceeded upon false data.

2. It is a question of very considerable doubt, whether any portion of the country between the Belize and the Hondo is conterminous with Mexico, and whether the whole of it is not conterminous with Guatimala. There are very strong reasons for inclining to the latter opinion, and if that be correct we are not bound by any real or imaginary title referred to in the treaty with Mexico, inasmuch as we have no treaty with Guatimala which touches that question, and, as I said before, one country cannot take advantage of any admissions, acknowledgments, or obligations, contained in a treaty between ourselves and another country. In our treaty with Mexico, it is stipulated that that country shall on no account molest or disturb British subjects in the peaceable possession of their rights within a certain line, impinging upon Mexican territory, but we have no treaty with Guatimala stipulating that British subjects shall not be disturbed within a certain line, impinging upon Guatimalian territory; if, therefore, it can be shown that the country between the Belize and the Hondo is conterminous with Guatimala, and not with Mexico, we have got no treaty obligation on the subject. The treaty with Mexico relates to a country bordering upon that state; it does not relate to a tract of country bordering upon another state. This must be the meaning of the treaty, or it has no meaning; for how could Mexico agree not to molest British subjects, except upon land bordering upon itself. If it referred to a country not necessarily bordering upon itself, then Mexico would have agreed to abstain from doing what it was impossible she could do, and she might as well have agreed not to bottle up moonshine, nor prevent the sea from rising.

It is a notorious fact, that, previously to the treaties, the whole of British Honduras—the whole of the country between the Siban and the Hondo—was included in the kingdom of Guatimala. In Mr. Black's British Atlas, on the map of Mexico, Guatimala is made to include the district of Peten. But Mr. Wright, in his Gazetteer, published in 1838, goes still farther, for he places Chiapas, a province very considerably to the north-westward of Peten, as may be seen on reference to the map, in Guatimala. He says, "Chiapas intendancy, Central America, Republic of Guatimala."

In the "Brief Statement concerning the Eastern Coast of Central America Commercial and Agricultural Company," it is said:—

"In this country, so highly favoured by nature, the Eastern Coast of Central America Company have had the good fortune to obtain from the government of Guatimala a grant by charter, date August 8th, 1834, of the whole of the state of Vera Paz, which is about 250 miles in length, and the same extent in breadth, lying between 15° and 19° north latitude, and 88° and 92° west longitude, and comprising at least 14 millions of acres." Thus it appears that the whole of Vera Paz is in Guatimala. In the Charter granted by the Government of Guatimala to the company, Vera Paz is stated to extend as far as the Rio Grande. This river is considerably to the north of the river Hondo. But what do the Americans say upon this subject? The Committee on Foreign Relations, in their report, say:—

"The Committee so far have conducted the inquiry upon the assumption that those British settlements on the Belize lie altogether within the territory of the Republic of Guatimala. They are, however, aware that this assumption may not pass unquestioned. In the treaty between Great Britain and Mexico, signed at London, December 26, 1826, it would seem, from expressions contained in the 14th article, that it was considered between those two powers, these settlements might be in whole, or in part, within the limits of Mexico, in the state or province of Yucatan, and by some of the European geographers (not Spanish) they are spoken of as in Yucatan. From the best sources of information, however, open to the Committee, they have formed a decided opinion that the boundaries allotted to these settlements by the treaties of 1785 and 1786, before referred to, lie within the republic of Guatimala."

From these authorities,—and many others might be quoted,—it is very apparent that British Honduras is not conterminous with Mexico. Consequently, the treaty of 1826, between Great Britain and that state, cannot, does not, lay down any limits which we are bound to observe.

3. But supposing there were no errors on either side when the treaty with Mexico was concluded,—and supposing that the whole of the country between the Belize River and the Hondo is conterminous with Mexico, still the 14th article, as far as it relates to boundaries, is worthless, because there is no such line as the one described to be found in nature,—it is entirely a creation

of the imagination, and evidently the offspring of the brains of the same ingenious individual who fancied that cutting down mahogany trees multiplied their growth. The words of the treaty are as follows:—

"It is expressly agreed that his Britannic Majesty's subjects shall have the right of cutting, loading, and carrying away logwood in the district lying between the River Wallis, or Belize, and Rio Hondo, taking the course of the said two rivers for unalterable boundaries so as that the navigation of them be common to both nations, to wit, by the River Wallis, or Belize, from the sea, ascending as far as opposite to a lake or inlet which runs into the land, and forms an isthmus, or neck, with another similar inlet, which comes from the side of Rio Nuevo, or New River, so that the line of separation shall pass straight across the said isthmus, and meet another lake formed by the water of the Rio Nuevo, or New River, at its current. The said line shall continue with the course of Rio Nuevo, descending as far as opposite to a river, the source of which is marked in the map, between Rio Nuevo and Rio Hondo, and which empties itself into Rio Hondo, which river shall serve as a common boundary as far as its junction with Rio Hondo, and from thence descending by Rio Hondo to the sea. We are told to ascend the River Belize until we come to a lake or inlet. Let us do so; and from the mouth to the source of that river, where do we find such lake, or inlet? A main river is that which contains the largest body of water. A branch of a river is a smaller stream, which flows out of it. A tributary stream is an independent water, which flows into it. So the stream marked on the map as flowing from the south-west at its source, in a north-easterly direction to the sea, is the Belize river,—all the other streams connected with it are either tributaries or branches. Well, then, ascending the Belize river, where do we find this lake or inlet? Nowhere; as Macbeth says, "There's no such thing,"—it is but "An inlet of the brain, a false creation,—proceeding from the heat-oppressed brain."

When you get about 40 or 50 miles up the river Belize, you come to a stream called Black Creek. If you ascend this creek (as it is called), you will assuredly arrive at some such lake or inlet. But Black Creek is not the Belize river, neither is it a branch of it. In this country they have long been in the habit of misapplying the word creek. A creek is a small inlet into the shore from the sea or a river. In Jacob's Law Dictionary, it is thus defined:—"Is a part of a haven where anything is landed from the sea; so that it is observed, if when you are out of the main sea within the haven, you look round and see how many landing-places there are, so many creeks may be said to belong to that haven. It is also said to be a shore or bank whereon the water beats, running in a small channel from any part of the sea." In this country the term has always erroneously been used to signify a small stream, or the branch of a main river. Webster says:—"In some of the American states it means a small river, but this is contrary to English usage, and is not justified by etymology; but as streams often enter into creeks and small bays, or form them, the name has been extended to small streams in general."

I have stated that Black Creek is neither the Belize river nor a branch of that river. A branch is that which grows out of a thing, not that which flows into it. When a river in its course divides itself into several streams, it is said to ramify, from the Latin word *ramus*, a bough or branch. Now, a branch always proceeds, never accedes. Black Creek, therefore, is not a branch of the Belize. It is an independent stream, it has a source of its own, it flows into the Belize, and it has no relationship to it whatever, until its waters are swallowed up and merged in that river. But to get to this "lake or inlet" we are "to ascend the river Belize," not Black Creek, and ascending this river Belize, according to our instructions, we nowhere come to any such lake or inlet as that to which the treaty refers. If I give to a person the whole of the land on the bank of a river, from the mouth upwards, as far as a castle built of crystal, with a hundred turrets of jasper, and fifty golden gates, and if he ascend that river, and, between the mouth and the source, he finds no such castle, that it is *un chateau en Espagne—un castillo en el aire*,—he would, I apprehend, take all the land situated between those two termini. That the stream marked on the map is the Belize river, and not the one marked Black Creek, the treaty of 1786 proves. That treaty, which extends the limits, says:—"The English line, beginning from the sea, shall take the centre of the River Siban, or Jabon, and continue up to the source of the said river; from thence it shall cross, in a straight line, the intermediate land, till it intersects the river Wallis (Belize), and by the centre of the same river, the said line shall descend to the point where it will meet the line already settled, marked out by the Commissaries of the two crowns in 1783." We are to descend until we arrive at that point. Now, that point is a lake, or inlet, and the only point answerable to it is to be found at a considerable distance up the Black Creek. How, then, by "descending the Belize river," can we ever arrive at that point? In order to do so, we must first descend the Belize river, and then ascend the Black Creek. But the treaty does not say so. It says—"And by the centre of the same river the said line shall descend to the point." Well, then, I contend, that neither in ascending nor descending the Belize river do you come to any such lake or inlet. Then, again, it is said:—"The said line shall continue with the course of Rio Nuevo, descending as far as opposite to a river, the source of which is marked in the map, between Rio Nuevo and Rio Hondo, and which empties itself into Rio Hondo.

Again, my argument is founded upon non-existence, if I may be allowed to use such a paradoxical phrase. The commissaries of the two crowns, (the same ingenious worthies who invented a new mode of multiplication by means of subtraction) were extraordinary men. They established lakes and rivers where none existed before. They made rivers change their course and flow backwards. And there is not the least doubt that they could, if they had been put to it, have caught red herrings in the Hondo, and pickled salmon in the Siban. There is no such river as the one mentioned in the treaty,—it is purely an imaginary stream. It may be found, perhaps, upon a Spanish map. Anything may be put upon a map. Just as a man may leave anything in his will, whether he has it or no. But it is not found in nature, and the limits are professed to be defined by natural boundaries. If, then, the natural boundaries referred to as the land-marks of our territory, are not to be found, how are we to define the limits? We must have recourse to those objects which do exist, and they must be the boundaries. The treaty says the Belize river and the Rio Hondo shall be unalterable boundaries. As the treaty with Mexico fails then to affix any ascertainable limit to our territory, because it refers to a line which has no existence, the territory, therefore, is co-extensive with the whole of the country which lies between the Belize and the Hondo, of which we have been in possession since 1798. In the consideration of this very important subject, a question of considerable moment arises,—which is the Rio Hondo? In the map, three streams will be observed, all of which commingle and flow in one body to the sea. At the mouth it is unquestionably the Hondo; but which of these three streams is the main river? There cannot be three Hondos, and that river cannot commence at the confluence of the streams, but must begin as the Hondo at its source, and continue as the Hondo until it arrives at the sea. For instance, the river Tagus has its source in the Sierra Albarracin; it flows for 600 miles, but before it arrives at the sea it receives into its bosom the Molina, the Jarama, the Alberche, the Alagon, the Zezere, the Rio del Monti, the Salor, and the Sola. But it has its own independent stream, which is the Tagus from the source

to the sea. Tributary streams have a separate existence and a name until they reach the main stream, when they lose their individuality, and become merged, as an estate for life, or for years, is swallowed up and drowned in the fee. Which of the three streams marked upon the map is the main river, or Hondo? One is called Booth's river, one Victoria creek, and another Blue creek. I have already said that a branch of a river is a stream which flows *from* that river, and not one which goes *to* it. Booth's river and Victoria creek, therefore, not flowing *out* of, but *into*, are not branches, but independent streams, having sources of their own, and characteristics belonging to themselves. It has been asserted that Booth's river is the main river, or Hondo. Now, if we were to admit that, we should lose a large tract of country, consisting of the most fertile plains, and mountains clothed to their summits with the most luxuriant vegetation. But we are not at all prepared to admit this; on the contrary, we assert, and are ready to maintain, *à toute outrance*, that the stream called Blue creek is the main river, or Hondo. How are we, when there are several streams, to ascertain the main river? I take it that that stream which is the widest, the deepest, and which contains the largest body of water, is the main river. That river which receives other waters is the main river. At the point of junction, Booth's river and Victoria creek are narrow and shallow streams in comparison with Blue creek. If Blue creek flows into Booth's river, then Booth's river is the main stream. But how can a larger body of water flow into a smaller body of water? The smaller cannot contain the larger. You cannot put St. Paul's Cathedral into St. Paul's, Covent-garden. It comes to this,—that is the main river into which other rivers flow,—a larger stream cannot flow into a smaller stream, but *vice versa*. Booth's river and Victoria creek are smaller streams, consequently if they join Blue creek, Blue creek cannot flow into them, but they must flow into Blue creek, consequently Blue creek must be the main river—*quod erat demonstrandum*. The very term "Blue creek" implies deep creek. Blue water always means deep water. When a ship has got out of soundings, the sailors say "they have got into blue water." Blue creek therefore means deep creek, and deep creek means Hondo. Hondo is a Spanish word, and it signifies "profound, deep, far below the surface." The Spaniards gave this name to the river in question, on account of its depth. Blue creek and the Hondo, then, are convertible terms, both signifying deep river.

In the course of this argument (very heavy and tedious I fear), I have occasionally alluded to Americans and American statesmen. I bear them no disrespect. I entertain the highest opinion of the statesmen, the jurists, and the literary and scientific men of the United States, and towards Americans generally I cherish the warmest feelings of brotherhood. They are an enterprising, a brave, and a noble people. And, as I have spoken of rivers, may that great branch of the maternal stream, as it pursues it majestic course, flowing onwards, swelling and enlarging, fed by a thousand meandering rills and mountain torrents, to the goal of all human things, not forget, in its plenitude and in its power, the source from which it sprung, and may we also bear in mind that kindness, forbearance, and brotherly love on our part, are the best means of preserving that remembrance.

SOUTH KENSINGTON MUSEUM.

During the week ending 12th June, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,824; on Monday and Tuesday (free evenings), 3,093. On the three Students' days (admission to the public 6d.), 808; one Students' evening, Wednesday, 122. Total, 6,847.

MEETINGS FOR THE ENSUING WEEK.

TUES. ......Med. and Chirurg., 8½.
Zoological, 9.
WED. ......Geological, 8. I. M. Abich, "On the Structure of Etna." II. Prof. Haughton, "On Lepidomelene in some of the Granites of Ireland." III. Mr. H. Godwin-Austen, "On the Geology of a part of Kashmir." And other Communications.
Royal Soc. Lit., 8½.
THURS. ...Royal Soc. Club, 6. Anniversary.
Society of Arts, 10. Conference of Representatives of Institutions in Union. 6. 104th Anniversary Dinner.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 8th June, 1858.

316. Royal Military College, Sandhurst—Prospectus of the next Competitive Examination.
317. East India (Correspondence, &c.)—Return.
318. Sasines (Scotland)—Return.
104. Bill—Funded Debt.

Delivered on 9th June, 1858.

300. Barracks—Copies or Extracts of Correspondence.
313. National Collections—Return.
315. Anchors—Return.
108. Bills—New General Post Office (Edinburgh).
109. ——— Transfer of Land.

Delivered on 10th June, 1858.

304. Archdeaconry of Middlesex—Return.
103. Bills—Landed Estates (Ireland).
111. ——— Copyhold Acts Amendment.

Delivered on 11th June, 1858.

312. National Debt—Return.
322. East India (Memorials, &c.)—Return.
106. Bills—Local Government (amended).
114. ——— Leases and Sales of Settled Estates Act Amendment.
117. ——— Public Grounds and Playgrounds (amended).

Delivered on 12th and 14th June, 1858.

301 (1). Army (Captain Grant's Kitchens)—Further Return.
311. Game Certificates (Ireland)—Return.
174. Pilotage—Abstract of Returns.
320. Loans, &c., to Foreign States—Account.
321. Civil Service Estimates (Unexpended Balances)—Return.
325. Wine and Spirits—Account.
330. Exhibition of 1851—Correspondence.
89. Bills—Copyright of Designs.
112. ——— Joint Stock Companies Act Amendment.
119. ——— Wills, &c., of British Subjects Abroad.
120. ——— Galway Harbour and Port Act Amendment (Ireland).
121. ——— Peace Preservation (Ireland) Act Continuance.
105. ——— Sale and Transfer of Land (Ireland) (amended).
113. ——— Clerk of Petty Sessions (Ireland).
116. ——— Members' Freedom from Arrest.
118. ——— Commissioners for Exhibition, 1851.
122. ——— Cowley's Charity.
123. ——— Harvey's Charity.
124. ——— Bristol Municipal Charities.
125. ——— Bristol Saint Nicholas and Saint Leonard's Charities.

Delivered on 15th June, 1858.

327. Sasines (Scotland)—Return.
331. Mr. John Townsend—Copy of Record of Adjudications of Bankruptcy.
110. Bills—Markets and Fairs (Ireland) (amended).
127. ——— Drafts on Bankers Law Amendment (amended).

Delivered on 16th June, 1858.

324. East India (Oude)—Copy of Letter of Captain Evans.
128. Bill—Stanhope and Wolsingham Rectories (amended).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June* 11, 1858.]

Dated 29th April, 1858.

958. W. Smith, 18, Salisbury-street, Adelphi—Imp. in steam ploughs. (A com.)

Dated 5th May, 1858.

996. C. D. Archibald, Rusland-hall, Lancashire—A new and improved mode of treating air and gases, and applying the same for purposes of motive force.

Dated 10th May, 1858.

1038. R. B. Goldsworthy, Manchester—Imp. in machinery for grinding emery and other materials.

Dated 19th May, 1858.

1110. G. M. Casentini, 24, Hercules-buildings, Lambeth—The manufacture of a solution for mixing with or guaging plaster of Paris (or any plaster having sulphate of lime or any similar substance for its base), so as to produce a hardened dense composition, the hardening or setting whereof may be retarded and regulated by the person using the same.

1116. G. M. Miller, Great Southern and Western Railway—Imp. in the joints of bridge rails for railways.

1118. W. E. Newton, 66, Chancery-lane—Imp. applicable to certain descriptions of marine engines, and in the mode of mounting paddle-wheel shafts. (A com.)

1120. W. Clark, 53, Chancery-lane—Imp. in machinery for manufacturing knotted webs or nets. (A com.)

Dated 20th May, 1888.

1122. J. Hesford, Bolton-le-Moors, Lancashire—Imp. in the construction of stretching machines for cotton and other woven fabrics.

1124. A. F. Cossus, Cagliari, Sardinia—Imp. in treating oils and fatty matters.

1126. J. Copcutt, 5, Park-place, Newland-street, Kensington—An imp. in preparing materials employed to obtain light when using oxygen and hydrogen gases.

1128. R. A. Brooman, 166, Fleet-street—A method of, and apparatus for, purifying sulphuret of carbon. (A com.)

1132. M. Henry, 84, Fleet-street—Imp. in the manufacture or preparation of ink and paper, to adapt them for copying purposes, in preserving food, skins, and hides, in rendering lint, vesicatory paper, and textile fabrics absorbent, and in treating mortar, cement, and other matters, in order to keep them in a damp state. (A com.)

1134. G. F. Muntz, French Walls, near Birmingham—An imp. in preparing yellow metal sheathing.

1136. S. Bryer, St. George's-terrace, Cheltenham—Improved instruments to be used in the sensitizing and developing of photographic plates.

Dated 22nd May, 1858.

1140. P. Féron, Theuville-aux-Maillots, France—An improved bandage or truss.

1142. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for embroidering. (A com.)

1144. J. Foot, Spital-square—An imp. in the manufacture of fringes.

1146. T. S. Cressey, High-street, Homerton—Imp. in apparatus for calculating wages. f

1148. A. P. Price, Margate—Imp. in the treatment and smelting o certain argentiferous or silver ores.

1150. G. White, 34, Dowgate-hill—A liquor suitable for manufacturing beverages, and for culinary purposes. (A com.)

1152. I. Baggs, Doddington-grove, Kensington—Imp. in electric telegraphs, and in the apparatus employed therein and therewith, parts of which are applicable to other electrical purposes.

1154. W. Clark, 53, Chancery-lane—Imp. in machinery or apparatus for moulding articles of cement. (A com.)

Dated 26th May, 1858.

1177. J. Luis, 1b, Welbeck-street, Cavendish-square—A distilling pipe. (A com.)

1179. J. Luis, 1b, Welbeck-street, Cavendish-square—The application and use of the fibrous textile plant, called in Arabia "diss," or in Latin "arundo festuca patula," or by botanists "festu coides et donax tenax," in the manufacturing of pulp for paper, and tow for thread, tissues, and cordage. (A com.)

1183. W. Cowan, Edinburgh—Imp. in machinery or apparatus for disengaging horses from carriages in cases of accident.

1185. M. Henry, 84, Fleet-street—A new or improved fabric and improved sewing and stitching machine, especially applicable for manufacturing the same. (A com.)

1187. J. Stuart, Sly Kate's-hill, Chatham—An imp. in distilling asphalte, pitch, tar, and other bituminous substances.

Dated 27th May, 1858.

1189. A. C. Engert, City-road—A method of preparing tin foil, or leaf, in order to its employment as a substitute for silver leaf. (A com.)

1191. C. Cuit and A. Godefrey, Paris—Imp. in railway brakes.

1193. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in machinery for combing and preparing wool, cotton, and other fibrous materials. (A com.)

1195. V. L. Vodoz, Westminster Club, Albemarle-street—An imp. on the chimneys and glasses of gas and other lamps.

1197. J. Bower, Hunslet, near Leeds—Imp. in the manufacture of glass.

Dated 28th May, 1858.

1199. C. Stanley and J. Fittall, Birmingham—Imp. in skylights and glass roofing.

1201. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved key-joint for connecting detached pieces of wood or metal. (A com.)

1203. L. Tindall, Sherwood Foundry, Mansfield—Imp. in machinery, or apparatus for sweeping and cleansing roads and streets.

1205. A. Godet, 31, Rue St. Hubert, Bordeaux, France—Imp. in raising weights.

1207. E. Bond, Wharf-road, City-road—An improved aerated liquid.

Dated 29th May, 1858.

1209. E. Sykes, R. Sykes, and P. Sykes, Huddersfield—Imp. in continuous spinning and roving machines for spinning and roving wool, a part of which is applicable to spinning other fibrous substances.

1211. A. Dold, Chatham—Improved apparatus for winding clocks, which apparatus is also applicable as a motor for all machinery usually turned by hand, horse, or other power, and for preventing the descent of smoke into chambers or other places.

1213. J. Martin, Newman-street, Oxford-street—Imp. in means or apparatus for the prevention or cure of smoky chimnies.

1215. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved fumigating apparatus. (A com.)

1217. M. Henry, 84, Fleet-street—Improvements in, and in preparing agents for, dyeing, preparing for dyeing, and tanning, and applying certain of the resulting products for obtaining pulp for paper and pasteboard, and the manufacture of blacking. (A com.)

Dated 31st May, 1858.

1219. J. Young and J. Strang, Castle Glen and Glasgow—Imp. in the manufacture of starch, gum, or dextrine, and their compounds.

1221. J. B. Girerd, 36, Newman-street, Oxford-street, and P. F. Wohlgemuth, 57, New Bond-street, Hanover-square—Imp. in ornamental staining, dyeing, and fixing designs, writing, letter-press and type printing and cyphering, and colours, on wood or any other substances, also extracting, transferring, or discharging colours from the same.

1223. W. Parsons, Pratt-street, Old Lambeth—Imp. in steam engines, for propelling vessels and other purposes, and in bearings for the screw shafts of steam vessels.

1225. W. E. Newton, 66, Chancery-lane—Imp. in printing and dyeing textile and other fabrics. (A com.)

Dated 1st June, 1858.

1227. C. Binks, London—Imp. in manufacturing soap.

1229. C. F. Vasserot, 45, Essex-street, Strand—A kind of tramway to facilitate the locomotion of bedsteads. (A com.)

1231. A. G. Grant, New York—An improved stand or rest for cameras, theodolites, guns, and other articles.

1233. J. Lang, Calder-vale, Garstang, Lancashire—An improved method of signalling on railways.

Dated 2nd June, 1858.

1235. J. Mannhardt, Munich—An imp. in machinery for the manufacturing of peat fit for fuel, and for the squeezing or forcing of fluids out of the said turf, peat, or similar substances.

1237. J. Luis, 1b, Welbeck-street, Cavendish-square—A new description of plough, with fore-carriage applicable to all swing or common ploughs. (A com.)

1239. C. Wheatstone, Hammersmith—Imp. in electro-magnetic telegraphs, and in apparatus connected therewith.

1241. C. Wheatstone, Hammersmith—Imp. in electro-magnetic telegraphs, and apparatus used for transmitting signs or indications to distant places by means of electricity.

1243. J. E. F. Luedeke, Marke, Hanover—Imp. in motive power engines.

Inventions with Complete Specifications Filed.

1264. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in railway wheels, and in axle-boxes and bearings for the same. (A com.)

WEEKLY LIST OF PATENTS SEALED.

11th June.

3057. J. Strather.
3060. J. Roberts and M. Beale.
3068. H. D. P. Cunningham.
3070. H. Bunting.
3194. C. Buhring.
204. R. Harland.
616. M. A. F. Mennons.
644. J. J. T. Schlœsing and E. Rolland.
842. M. A. F. Mennons.
886. G. Gilmour.

June 15th.

3075. J. Hogg, junr.
3076. W. Smith.
3077. E. Breffit.
3078. J. Bradley.
3079. J. Chadwick.
3084. T. Howard.
3085. G. A. Everitt.
3087. J. G. Gibson and S. Berrisford.
3091. E. Hills.
3092. H. Gregory.
3095. M. J. Turner and M. W. Turner.
3117. T. Hart, jun., and A. Jones.
3121. R. A. Brooman.
3134. J. Tatlow and H. Hodgkinson.
3136. W. Basford.
3197. A. J. M. Ramar.
9. Archibald Slate.
21. H. C. Jennings.
39. W. Church.
212. W. Rhodes and H. Napier.
709. C. Tress.
819. W. Spence.
875. W. H. F. Talbot.

Patents on which the Stamp Duty of £50 has been Paid.

7th June.

1306. C. C. J. Guffroy.
1312. I. Lippmann.
1313. G. F. Chantrell.
1318. C. F. Varley.

8th June.

1321. J. Robinson.

9th June.

1442. F. W. Mowbray.

June 10th.

1337. W. Armitage.
1340. W. B. Johnson.
1354. G. Cottam.
1365. W. Clay.
1425. R. Keevil.
1478. R. Besley.

June 11th.

1342. C. Parker.
1369. H. Mathis.

June 12th.

1350. W. Moxon and J. Clayton.
1353. J. Betteley.
1362. S. C. Lister.
1363. J. T. Chance.

Journal of the Society of Arts.

FRIDAY, JUNE 25, 1858.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society, for the purpose of receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure for the past year, and also for the election of officers, will be held on Wednesday next, the 30th instant, at 4 P.M. At the conclusion of the General Meeting, a Special Meeting for the election of members will be held.

The Annual Statement of Receipts, Payments, and Expenditure, for the year ending 31st May, 1858, is to be found at page 498.

SEVENTH ANNUAL CONFERENCE.

The Seventh Annual Conference between Representatives from the Institutions in Union and the Council of the Society, was held yesterday (Thursday), the 24th inst., at the Society's House, in the Adelphi. C. Wentworth Dilke, Esq., Chairman of Council, presided.

The following is a List of the Institutions and Local Boards represented at the Conference, with the names of the respective representatives :—

Ashford, Mechanics' Institute	Mr. Hen. Whitfield.
Banbury, Mechanics' Institute	Mr. T. A. Hedley.
Barnet, Institute	Mr. Stephen Baldock.
Bedford, Literary Institution	Mr. James Wyatt.
Berkhampstead (Local Board)	Rev. J. R. Crawford.
Birmingham, Messrs. Chance's Library and Reading-room	Mr. F. Talbot.
Bradford (Yorks), Mechanics' Institute	Rev. J. H. Ryland.
Braintree and Bocking, Literary and Mechanics' Institution	Mr. Geo. Courtauld.
Bridgwater, Literary and Scientific Institution	Rev. A. W. Worthington.
Brighton Athenæum	Mr. W. D. Savage.
Brighton, (Local Board)	Mr. W. Wakeford Attree.
Bristol Athenæum	Rev. Canon Girdlestone and Mr. Edward Halsall.
Bury St. Edmund's Athenæum	Mr. R. Craske.
Chatham, Rochester, and Stroud Institution	Mr. R. Laws.
Chichester Literary Society and Mechanics' Institute	Mr. H. W. Freeland.
Darlington Mechanics' Institute	Mr. Hen. Pease, M.P.
Dublin Statistical Society	Mr. H. D. Hutton.
Devizes Literary and Scientific Institution	Rev. P. A. L. Wood.
Falkirk School of Arts	Mr. R. W. Kennard.
Greenwich Society for the Acquisition and Diffusion of Useful Knowledge	Mr. James Spencer.
Halifax, Working Man's College	Mr. Josiah Anderson.
Halifax Mechanics' Institute	Mr. Frank Crossley, M.P.
Hants and Wilts Adult Education Society	Hon. and Rev. Samuel Best.
Hartlepool (West) Literary and Mechanics' Institution	Mr. Robert Reed.
Hastings, Mechanics' Institution	Mr. John Banks.
Hereford Permanent Library	Mr. William Aston.
Hertford, Literary and Scientific Institution	Mr. John Marchant, jun.
Highgate, Literary and Scientific Institution	Mr. James Yates and Mr. William P. Bodkin.
Huntingdon, Literary and Scientific Institution	Mr. Robert Honey.
Leeds, Mechanics' Institution and Local Board	Mr. Alex. McIvor.
,, Young Men's Christian Institute	Mr. William Heaton.
,, Yorkshire Union of Mechanics' Institutions	Mr. Edward Baines, Mr. J. Hope Shaw, Mr. Thos. Wilson, Mr. Jas. Hole, and Mr. Barnett Blake.
Lewes, Mechanics' Institution	Mr. W. Button and Mr. H. Browne.
Liverpool (Local Board)	Rev. Dr. Hume.
Lockwood Mechanics' Institution	Mr. John Bentley, J.P.
London, Brompton (West) Literary and Mutual Improvement Society, and Local Board	Mr. Ivan C. Jenkyns.
,, Clerkenwell Working Men's Institute	Mr. H. A. Nash.
,, Crosby Hall Evening Classes	Mr. W. D. Boulter.
,, Hackney Literary and Scientific Insuitution	Mr. Henry Althans.
,, Mechanics' Institution and Local Board.	Mr. T. Allen Reed, Mr. S. Valentine, and Mr. T. J. Pearsall.
,, Newington Tailors' Labour Agency Literary Institute.	Mr. R. Edwards.
,, Royal Polytechnic Institution Classes	Mr. J. C. Buckmaster.
,, Sherwood Mutual Improvement Society	Mr. William Ness.
,, Walworth Literary and Scientific Institution	Mr. J. S. Noldwritt.
Manchester, Mechanics' Institution and Local Board	Mr. Robert Rumney.
Newport Athenæum and Mechanics' Institute	Sir Thomas Phillips.
Northallerton Institute	Mr. W. B. Wrighton.
Peterborough Mechanics' Institute	Dr. Henry Porter.
Plymouth Mechanics' Institute	Mr. Edward Lane.
Portsea, Watt Institute	Mr. Andrew Murray.
Portsmouth and Portsea, Literary and Philosophical Society	Mr. W. Hamilton, R.N.
Reigate, Mechanics' Institution	Mr. Thomas Martin.
Richmond Young Men's Society	Dr. Ellis.
Selby Mechanics' Institution and Local Board	Mr. Thomas Werrey.
Sevenoaks, Literary and Scientific Institution	Mr. George Franks.
Wigan, Mechanics' Institute	Mr. H. Woods, M.P.
York, Institute of Popular Science and Literature	Right Hon. Lord Londesborough.

The Secretary read the following

REPORT

To the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—In my report read to the Conference last year, I took occasion to review the proceedings of the Union during the first five years of its existence, showing what had been contemplated at its formation, what had been achieved, and what remained to be done. It was gratifying to find that a large proportion of the objects originally contemplated had been attained, and were in operation for the benefit of the Union, whilst others were making satisfactory progress, though some had been found impracticable. At the date of my last report, a Bill, promoted by this Society, for amending the law relating to the exemption of Literary Societies from Local Rates, was before the House of Commons, under the charge of Messrs. Hutt and Ewart. The Society, as well as many Institutions, petitioned in its favour, but the House of Commons then recently elected exhibited such strong objections to the principle of exemption generally, that they would not give their sanction to the measure. It was carefully pointed out that all that was asked was, not a new law involving a new principle, but an explanatory Act, to render available existing enactments, which, by a strict literal interpretation of the Courts of Law, were rendered all but useless for the purpose for which they were intended. The result of the debate showed that in the House of Commons public opinion was rising strongly against the principle of exemption, and a committee appointed by the House of Commons, with the assent of the Government, is now inquiring into the operation of the law, by which land occupied by public establishments is rendered exempt from local rates and taxes. It would, therefore, be unwise under these circumstances, for the present, at all events, to moot the question again.

At the last conference I could only report the results of the Examinations that had taken place in London, the Examiners not having at that time made their awards in respect of the Huddersfield Candidates. The results of the Huddersfield Examination were subsequently published in the *Journal*, rendering it needless for me now to take up your time by recapitulating them. I cannot, however, omit to mention, that since that report was made, four Candidates who distinguished themselves at the Society's Examinations last year, Frank Marshall, Henry Cullum, Edward Highton, and Edward Philip Plowman, have been appointed to clerkships in the Privy Council Office.

I will now call attention to the Examinations of the present year, which have just been held. The results, so far as the awards of Prizes and Certificates to the Candidates, have already appeared in the Society's Journal, a copy of which has been sent to each of the Candidates.

The institution of these Examinations has been for several years one of the great objects of the Union. It has taken some time to bring them into effectual operation. The Institutions themselves had to learn the value of examination as an instrument of education. The proposal to hold an examination of the members of, or students of classes in, the Institutions, when first made, met with approval, but it was not till the Council had repeatedly called the attention of the Institutions to its importance, that the first Examination could be established.

In June, 1856, the experiment was tried, by undertaking to hold an Examination in London at the Society's House. Fifty-two candidates attended, and the experiment was, so far as it went, a successful one. Examinations in London, for a Union extending into almost every county in England, and embracing Institutions in Scotland and Ireland, were obviously inadequate for the purpose, and the Council, in the following year, 1857, desired to extend the experiment, and make a further trial of the system, so as to see how far it would meet with encouragement in the country, and it was determined to hold Examinations in 1857 not only in London, but in one country centre as well. Huddersfield, the head-quarters of the Yorkshire Union of Institutions for that year, was chosen as the additional centre, and the result showed that the provinces were not behind the metropolis in their appreciation of the advantages of the Examination system, and the year 1857 produced 80 Candidates in London, and 140 at Huddersfield.

The second experiment having shown that the members of the Institutions were now becoming prepared to take advantage of the Examination scheme, it became a matter of serious consideration in what manner the Examinations could be organised, so as to bring them within the reach of the members of the Institutions in Union, scattered throughout the kingdom.

On all hands it had been pointed out—indeed it was obvious, that one, two, or three centres of examination would be wholly inadequate to the wants of the Union. To adopt more, involved an expense which the Society was in no condition to undertake, even if there were not other difficulties which would render such a system impracticable. From the very nature of the case, the Examinations must be simultaneous. To send a complete set of examiners to each centre simultaneously, involved a condition which, even if funds could be provided for its fulfilment, would not admit of that uniformity in the awards of Certificates and Prizes which is essential to success.

The Council, after an anxious consideration

of the question, determined to adopt the scheme originally put forth, namely, to hold an Examination wherever an Institution, or a group of Institutions, would make satisfactory arrangements for the due and honest working of the Examination papers by the Candidates. It was felt that by no other system could the Examinations be conducted so as to be brought within the reach of those for whom they were intended, the members of the Institutions in Union, who have neither the time nor the money to enable them to make journeys to distant centres. To carry out the system, the Council invited the formation of Local Boards, and imposed upon them the further duty of holding a preliminary Examination to test the handwriting and spelling of the Candidates, their knowledge of English grammar, and of the common rules of arithmetic, as well as their knowledge of those special subjects in which they proposed to be examined by the Society's Examiners. The object had in view by this arrangement was two-fold. In the first place, it was absolutely necessary that some check should be established, to prevent the Society's Examiners from being overwhelmed by a flood of papers from incompetent candidates; and, in the next place, it was thought that the establishment of such Boards would raise up local bodies interested in the subject—tend to promote the formation of classes, and thus bring fresh candidates in subsequent years. The Council, as early as circumstances permitted, issued the Programme of the Examinations to be conducted on this system. It was, for reasons to which it is unnecessary for me to allude, delayed in its publication, and was not issued till December, giving a shorter notice both to the Institutions and the Candidates than was desirable. This it is proposed to remedy for the next year, and the present Council have prepared the Programme and Time-table, so that their successors in office may issue them both immediately after the Conference.

However, notwithstanding this delay, the matter was taken up heartily by the Institutions, and the result has been the formation of fifty-eight Local Boards, a much larger number, taking all the circumstances into consideration, than could have been anticipated. A list of these Local Boards is given in the Appendix. Forty of these Local Boards held the Previous Examinations, and returned candidates to the Society's Final Examinations, which took place at these forty localities, simultaneously, in Whitsun week, according to a time-table prepared by the Council, so that the same papers in each subject were worked all over the Union on the same days, and at the same hours. Very stringent rules were laid down by the Council, for the guidance of the Boards, in order to ensure the honest working of the papers by the candidates. The papers were sent down to each Board in sealed packets, with strict injunctions for their being opened in the presence of the candidates, at the special hours and on the special days appropriated for the subjects. The papers, when worked by the candidates, were returned by the Local Boards, accompanied with a declaration, signed by a given number of the Board, to the effect that the papers forwarded therewith were worked, in the presence of a certain number of the Board, by the candidates whose numbers they respectively bore, without any assistance whatever, from books, notes, memoranda, from each other, or from any other person, and that not more than three hours were occupied in working the papers, and that no candidate was allowed to resume, or complete, his paper after having left the examination room in the course of the time assigned to that paper, and further, that the paper of questions given to each candidate was taken from the envelope in which it was transmitted from the Society of Arts, the seal being broken in their presence and in that of the assembled candidates, at the commencement of the time appointed for the paper in the time-table issued by the Society; and, finally, that not fewer than a certain number of the Local Board were present during the whole time that the candidates were engaged with the papers.

The Local Boards, in every instance but one, have most carefully attended to all the regulations; this is a most gratifying circumstance to report, and the Council, as well as the members of the Institutions, must feel deeply indebted to those gentlemen who have, as members of the Local Boards, devoted their time and labour to this object. In the one instance to which I have referred, the Council had no option but at once to withdraw the papers of the candidates. It was felt that, however hard it might be upon the individual Candidates, who thus suffer from no fault of their own, to take a different course would be to imperil the whole system, and destroy public confidence in the Examinations.

The number of Candidates who attended the Previous Examinations was 1,107. Of this number 501 were declared by the Local Boards as eligible for the Final Examination; of them 288 were subsequently examined in Whitsun week, 361 Certificates were awarded to 197 Candidates; 78 Candidates were unsuccessful, and 12 were disqualified through informality. The number of papers looked over by the Examiners was 582, and the Certificates awarded were as follows: Fifty-three of Excellence, or the 1st grade; one hundred and thirty-two of Proficiency, or the 2nd grade; and one hundred and seventy-six of Competency, or the 3rd grade. Two hundred and twenty-two papers failed to obtain a sufficient number of marks to justify the award of any certificate in respect of them. With regard to the occupations of the Candidates,

the returns show that there were 46 clerks, 7 mechanics, 6 book-keepers, 7 engineers, 4 shipwrights, 7 warehousemen, 2 schoolmasters, 9 printers and compositors, 4 chemists and druggists, 3 surveyors, 3 porters, 3 butchers, besides a grocer, turner, woolsorter, saddler, clothdresser, veterinary surgeon, plasterer, watchmaker, brushmaker, iron moulder, draper, draper's assistant, letter-carrier, a gentleman's servant, a butler, an auctioneer, a millwright, cabinet maker, house decorator, chain maker, mechanical draughtsman, stover, weaver, shovel maker, bricklayer, cardroom hand, carpenter, bank cashier, tobacconist, spinner, joiner, worker in a chemical laboratory, governess, (5 other women,) confectioner, marqueterie cutter, engraver, finisher, painter and glazier, assistant master of workhouse, mason, music seller, overlooker. In the Appendix will be found a tabular statement of the ages of the Candidates.

The list of Prizes and Certificates awarded was given in the last number of the *Journal*, but an error in the return from the Crosby-hall Evening Classes having been found, the corrected list will be printed with the Programme for next year.

Such have been the results of the present year's Examination. The establishment of fifty-eight Local Boards is a remarkable event, from which much future good may be anticipated. The direction in which such Local Boards can most usefully employ themselves, forms a matter for discussion at the present Conference.

Three-and-twenty Institutions have joined the Union during the year, whilst during the same period thirty-four have been removed from the Society's books. A large proportion of these have either ceased to exist altogether, or have been unable to continue from want of means to pay the annual subscription. Few comparatively have resigned, and I may venture to report with confidence that the Union never has been in a stronger position than at the present moment, though there have been periods when a larger number of Institutions stood on the Society's books. In the earlier days of the Union the Institutions were allowed to remain longer in arrear, in the hope that they might ultimately be in a position to continue to remain connected with the Society, whilst during the last few years steps have been taken for removing from the list those which appeared unable to contribute the annual subscription, and hence the number of Institutions is less than it formerly was.

The condition of the Institutions is far better than when the Union was first established; there is more attention paid to the really useful objects for which their founders intended them; there are more classes; and, on the part of the public, there is a more general appreciation of their capabilities for good.

These facts, coupled with evidence of their increasing numbers in all directions, contradict the oft-repeated statement that Mechanics' Institutions are failures. They are gradually, slowly it may be, but surely, taking a permanent position in the country, and when we see their results in the Examinations which have lately taken place, whether we look at the Society's Final Examinations, or at those which have been held in connection with the Provincial Unions, we cannot but see that they are exercising a powerful influence for good, and assisting very materially to bring about a vast improvement in the education of the country.

I am, Gentlemen,

Your obedient servant,

P. LE NEVE FOSTER,

Secretary.

The following subjects are proposed by the Council for the consideration of the Conference:—

1. At what season of the year can the Final Examinations be best held? At Easter, Whitsuntide, or at what other period?
2. Into how many separate periods should the time of the Final Examinations be divided? Into four periods, (say) from 2 to 5, and from 6 to 9, on some Monday; and from 6 to 9 on the following Tuesday and Wednesday? or

Into five periods, (say) from 9 to 12, from 2 to 5, and from 6 to 9, on a Tuesday; and from 6 to 9 on the following Thursday and Friday? or

Into six periods, (say) two periods, Monday, 2 to 5, 6 to 9, and from 6 to 9 on the four following evenings.

These periods are merely suggested for illustration of the different arrangements that may be made. The object of the Council is simply to ascertain what will best suit the convenience of the Local Boards and of their Candidates.

3. Whether the present minimum age of candidates, 16, shall be retained, or whether it shall be raised to 17, or to 18.
4. In what manner the Local Boards can beneficially co-operate with the Institutions in forwarding the preparation of their Candidates for Examination.
5. Can the Local Boards advantageously act as administrators of "Prize Schemes" for children between 12 and 16 years of age, so as to induce them to continue their instruction between the time at which they leave their Elementary School, and the time at which they become admissable to the Examinations of the Society of Arts.
6. Whether the Central Museums and Galleries in the Metropolis, which are the property of the public, or subsidised from the public funds, could be rendered useful to the Institutions in different parts of the country, by systematically lending to them specimens for Exhibition, or by granting to them unrequired duplicates.
7. Whether the Conference should pass any Resolutions in favour of the opening of National Museums and Galleries to the public of an evening.
8. Whether the Society's List of Lecturers shall be republished.

APPENDIX.—I.

RESULTS OF THE EXAMINATIONS OF 1858.

LOCAL BOARDS.	No. of Candidates examined at the Previous Examination by Local Board.	No. of Candidates who passed the Previous Examination.	No. of Candidates examined at the Final Examination.	No. of Papers worked at the Final Examination.	No. of Candidates who passed the Final Examination.	No. of 1st Class Certificates awarded.	No. of 2nd Class Certificates awarded.	No. of 3rd Class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Prizes awarded to Local Boards.	No. of Prizes awarded to Institutions.	No. of Unsuccessful Candidates.
Banbury	2	2	2	4	2	2	2	0	2		2	0
Berkhampstead	10	10	8	8	6	0	3	3				2
Birmingham (Messrs. Chances' Works).	2	2	1	3	1	0	1	1				0
Blackburn	15	5	4	10	2	1	2	3				2
Bradford (Yorks.)	23	17	17	26	16	1	13	9				1
Brighton	3	3	2	4	2	0	2	1				0
Bristol	11	11	9	15	8	3	8	3	2		1	1
Greenwich	1	1	1	2	1	1	1	0				0
Halifax Mechanics' Institution	35	15	12	18	10	3	7	4	1			2
,, Working Men's College	67	21	15	23	11	1	4	10				4
Hartlepool (West)	5	3	2	5	2	0	2	3				0
Ipswich	7	6	5	11	4	0	5	4				1
Leeds Mechanics' Institution	13	10	10	22	8	2	6	7	2		1	2
,, Christian Institute	14	14	14	43	11	5	9	10	3		2	3
Lewes	2	2	1	5	1	0	2	1				0
Liverpool	35	35	32	56	16	3	8	17				16
Lockwood (Yorkshire)	1	1	1	2	1	0	1	0				0
London, West Brompton	4	4	3	6	3	0	3	2				0
,, Crosby Hall	27	25	24	39	17	11	8	19	6	1	3	7
,, Domestic Mission, Cripplegate	1	1	1	3	1	0	2	1				0
,, Mechanics' Institution	12	8	6	13	5	4	6	1		1		1
,, Royal Polytechnic	29	28	14	29	12	4	4	13	2			2
Louth	4	4	4	5	4	0	0	4				0
Lymington	1	1	1	5	1	1	3	1	1		1	0
Macclesfield	83	83	8	12	4	1	0	5				4
Manchester Institutional Association	591	100	12	0*	0*	0	0	0				0*
,, Mechanics' Institution	32	32	24	39	10	0	8	10				14
Newcastle-on-Tyne	3	3	3	5	3	0	1	3				0
Northowram (near Halifax)	1	1	1	4	1	0	0	3				0
Pembroke Dock	4	4	4	13	4	1	5	6				0
Portsmouth	2	2	2	13	2	3	5	4	3		4	0
Salisbury	1	1	1	2	1	0	0	2				0
Selby	10	9	9	11	3	0	2	2				6
Sheerness	1	1	0	0	0	0	0	0				0
Sheffield	20	18	16	23	9	3	3	5	3		2	7
Wakefield	4	4	4	6	3	0	0	5				1
Warminster	1	1	1	2	1	0	1	1				0
Wigan	9	6	6	11	5	0	2	5				1
Windsor	10		1	4	1	0	1	3				0
York	11	7	7	14	5	3	2	5				2
Total	1107	501	288	516	197	53	132	176	25	2	16	79

* Disqualified through informality.

II.

The following is a list of the places at which Local Boards of Examiners were formed in 1858. (At the places marked with an asterisk no Candidates were examined).

*Aberdeen.
*Bacup.
Banbury
*Basingstoke.
*Bedford.
Berkhampstead.
Birmingham.
Blackburn.
Bradford (Yorks.)
Brighton.
Bristol.
*Bucks and Berks Lecturers' Association.
*Carlisle.
*Dover.
*Glasgow.
Greenwich.
Halifax Mechanics' Inst.
,, Working Men's College.
*Hanley, Potteries Mechanics' Institution.
Hartlepool (West).
Ipswich.
Leeds Mechanics' Institution.
Leeds Young Men's Christian Institute.
Lewes.
Liverpool.
Lockwood.
London, Crosby Hall.
,, Domestic Mission.
* ,, Jews and General Literary Institute.
,, Mechanics' Inst.
,, Royal Polytechnic
* ,, Tailors' Labour Agency Literary Inst.
London, West Brompton.
*Longton.
Louth.
Lymington.
Macclesfield.
Manchester Institutional Association.
,, Mechanics' Institution.
*Middlesborough.
*Neath Mechanics' Institution.
Newcastle-on-Tyne.

Northowram.
Pembroke Dock.
Portsmouth.
*Richmond (Surrey).
*Salford.
Salisbury.
Selby.
Sheerness.
Sheffield.
*Slough.
*Stourbridge.
Wakefield.
Warminster.
Wigan.
Windsor.
York.

III.

This table shows the ages of the 307 Candidates whose return papers were received; of these 288 underwent the Final Examination.

Ages.	Number of Candidates.	Ages.	Number of Candidates.
16	45	27	7
17	30	28	7
18	33	29	5
19	43	30	1
20	36	31	5
21	31	32	4
22	15	33	2
23	10	34	1
24	9	35	3
25	7	37	1
26	11	49	1

IV.

Return of the numbers coming up for the Society of Arts Examination in each subject for the three years.

	1856.	1857.	1858.
Mathematics	27	...	...
Arithmetic	...	77	159
Book-keeping	...	46	48
Algebra	...	58	74
Geometry	...	52	53
Mensuration	...	42	44
Trigonometry	...	25	27
Conic Sections	...	14	14
Navigation, &c	...	4	5
Physics	...	...	...
Statics, Hydrostatics, &c.	...	11	14
Mechanics	13	...	...
Practical Mechanics	...	9	8
Magnetism, &c	...	9	4
Astronomy	...	...	5
Chemistry	16	22	13
Physiology	6	1	6
Botany	2	1	2
Agriculture	4	2	0
Political Economy	...	6	3
Geography	23	28	...
Descriptive Geography	...	...	29
Physical Geography	...	...	17
English History	38	24	43
English Literature	17	17	33
Latin and Roman History	15	19	12
French	17	38	68
German	7	15	13
Drawing	7	...	...
Free-hand Drawing	...	4	37
Mechanical Drawing	...	3	34
English Grammar and Composition	11	...	...

A report of the proceedings of the Conference will be given in the next number of the *Journal*.

ANNUAL DINNER.

The one hundred and fourth anniversary dinner of the Society took place at St. James's-hall, Piccadilly, yesterday (Thursday), the 24th inst., at six o'clock. The Right Hon. the Earl of Carlisle, K.G., presided. A report of the proceedings will appear in the next number of the *Journal*.

EXAMINATIONS, 1858.

Owing to a mistake made by the authorities at Crosby Hall, in the distribution of the numbered cards, some errors in the *names* of the candidates have been made in the list published last week. The following letter from the Assistant-Secretary of the Crosby Hall Evening Classes will explain this:—

"Evening Classes for Young Men, Crosby Hall,
"32, Bishopsgate-street Within, June 21, 1858.

"Dear Sir,—I beg herewith to forward a list of the names of the members of the Evening Classes who attended the recent Examinations, under the supervision of the Crosby Hall Local Board, with the numbers of their respective papers and cards, which, I trust, will enable you to correct the errors in the published list, which, I fear, must have been occasioned by our inattention to the appropriate distribution of the cards.

"I beg to remain, your obedient servant,
"W. D. BOULTER, Assistant-Sec.

"P. Le Neve Foster, Esq., Secretary."

The following is the corrected list of the *names* of the candidates from the Crosby Hall Evening Classes, who obtained prizes and certificates:—

Candidates' Numbers.

468—Robert James White (instead of J. J. Goldsmith), aged 20, clerk—Certificates of Excellence in Arithmetic and Book-keeping.

474—Thomas Ross Howard (instead of F. W. Potter), aged 22, clerk—A Certificate of Excellence, and a Second Prize of £3, in Arithmetic; and a Certificate of Excellence and a Second Prize of £3 in Book-keeping; Certificates of Proficiency in Algebra and in Mensuration.

485—Frederick William Potter (instead of R. G. Frost), aged 18, clerk—A certificate of Excellence in Arithmetic; and a Certificate of Competency in Algebra.

467—Henry Augustus Eliot (instead of R. C. Harrison), aged 24, clerk—A Certificate of Proficiency in Arithmetic, and of Excellence in Book-keeping.

469—John Stevens (instead of J. Fretwell), aged 29, customs officer—A Certificate of Competency in Arithmetic.

478—James Brady (instead of E. Highton) aged 19, carpenter—Certificates of Competency in Arithmetic and Mensuration.

472—Edward Philip Plowman (instead of T. Roberts,) aged 18, clerk—Certificates of Proficiency in Latin and Roman History, Conic Sections and Mensuration; and of Competency in Geometry.

473—Edward Highton (instead of J. Brady), aged 20, clerk—A Certificate of Excellence, and a Second Prize in Latin.

481—Robert Corney Harrison (instead of J. S. Dyer), aged 22, clerk—A Certificate of Competency in French.

483—John Fretwell (instead of R. J. White), aged 20, clerk—A Certificate of Excellence and First Prize in Political Economy.

476—William Thomas Sturgeon (instead of J. D. Gellen), aged 23, compositor—A Certificate of Competency in English History.
479—Thomas Roberts (instead of E. P. Plowman), printer—A Certificate of Competency in French.
475—James David Gellen, aged 18, clerk—A Certificate of Competency in French.
471—Richard George Frost (instead of J. Brignall), aged 21, clerk—A Certificate of Competency in German.

As the awards of the Examiners were made to the Candidates by *number* and not by *name*, it will be seen that the correctness of the awards is not affected by these mistakes.

The Secretary of the Liverpool Institute wishes it to be stated that the following successful Candidates, whose names appeared in the list published last week, belong to the Liverpool "Institute," and not to the Liverpool Collegiate Institution:—280. Edwin Guthrie; 283. Conyers Kirby; 290. Wilfred Johanning; 291. Malcolm Guthrie; 292. John Laurie; 293. Robert Gordon; 294. Richard D. Petterson; 295. D. C. Carmichael; 296. Samuel Cross; 299. Thomas W. Brooke; 300. Joseph Plaw.

The following corrections have been forwarded to the Secretary:—

For 87, John Clark Wise, read 87, John Clark Wroe.
For 89, William Hay, read 89, William Hey.
For 300, Joseph Plair, read 300, Joseph Plaw.
For 20, Alfred Pickard, read 336, John Stamford Walton, jun., aged 19, Northallerton Mechanics' Institution—A Certificate of Proficiency in Astronomy.

THE SOCIÉTÉ D'ACCLIMATATION.

A portion of land in the *Bois de Boulogne* has been granted by the City of Paris to this Society, with the view of establishing Zoological and Botanical Gardens, in which may be acclimatized such foreign animals and vegetables as either have been, or may be in future, introduced into France, and which may produce articles either of utility or luxury. The expenses are to be borne by a company which is in course of formation, and a special appeal is made by the Society to all who may be interested in the promotion of these objects. It is expected that considerable profits will be derived from the sum realized by the price of admission paid by visitors to the gardens, which, it is anticipated, will become very attractive to the public from their containing so large a number of new and interesting objects, many of them extremely rare and beautiful. The sale of these various articles is expected to yield a large and regular return; rare and valuable animals, the eggs of birds, various kinds of plants and grain may be mentioned as among those most likely to attract general notice.

A report drawn up by M. Geoffroy de Saint Hilaire has been recently published, which lays considerable stress upon the important results which are likely to accrue from the successful carrying out of this project. "If we consider," he says, "that the object of acclimatization is to give to each country, as far as possible, the advantages of the products of every part of the world brought to a state of perfection by the art of man; and when we remember what splendid results have been brought about in all ages by the isolated efforts of persevering and devoted men of science, how much may we not venture to expect from a Society such as this, which numbers among its supporters so many eminent men in every branch of knowledge, many of them of distinguished rank, whose devotion to the cause is so well known. It may be said of this Society that its heart is at Paris, but the members of its body are dispersed throughout the world; that it bears within itself the elements of a life longer than that of men, with a constant revivifying power, which enables it to carry on, with the necessary energy and perseverance, those labours which, when undertaken by individuals, are too often interrupted by death."

The following is a brief *résumé* of what the Society has already done. In 1854, the Society purchased half of the only herd of yaks which had been imported into Europe, and this animal has been, by its means, successfully acclimatised. In 1855, the Society distributed several hundred thousand bulbs of the yam, which is now largely cultivated, and which, it is hoped, may ultimately be a successful rival to the potato.

The cultivation of the *Sorghum saccharinum* has been largely promoted by means of the Society's efforts; this now furnishes to the central and southern districts of France a very excellent and abundant food for cattle, and it is hoped that, owing to the sweetness and purity of its juice, it will open up to the southern provinces a source of profit equal to that which the cultivation of beet-root has afforded to those of the north. The Society has become possessed of a large number of young plants of the Loza, a kind of buckthorn, from which is extracted the beautiful Chinese green, and which is found to resist even the severest winters known in Paris. With the assistance of Marshal Vaillant, General Daumas, and Abd-el-Kader, two flocks of the Angora goat, so remarkable for the fineness of its hair, have been imported, and these animals are found to increase in numbers each year, without showing any sign of degeneracy in the breed. Not only has this Society succeeded in acclimatising that species of silkworm which feeds on the castor-oil plant, but it has also been able to modify the food of these worms, and to substitute the leaf of the common teasel for that of the castor-oil plant, which is difficult to cultivate in France; and the regulation of the time of hatching has been so far effected, as to make the production of the worm itself almost contemporaneous with that of the leaf on which it feeds. By the assistance of a large number of French missionaries, who have become honorary members of the Society, the propagation in the open air of another species of silkworm, which feeds on oak-leaves. has almost been effected. Two new kinds of the Chinese oak are now growing in the nursery gardens at the Jardin des Plantes. The white Chinese nettle, from which it is said that fabrics of a stronger and more glossy character than those made from ordinary flax and hemp may be manufactured, is now being cultivated under the auspices of the Society. The cultivation of a species of pea, which produces oil in great abundance, and is found to be an excellent article of food, is very largely promoted by the Society, which has, moreover, received, in portable conservatories, living specimens of the trees known as the wax-tree and the varnish-tree, with the insects that inhabit them. With the view of restoring the fine qualities of the potato, which have been, to a great extent, lost by too extensive cultivation in Europe and by disease, the Society has had a large number of roots taken from the sides of the Cordillera mountains, and has imported them into France.

It is hoped that a Society which appears to have effected so much, with the small means hitherto at its disposal, will, now that its efforts are beginning to be more highly appreciated, be able to promote, to a large extent, the home production of many articles formerly imported at great expense, and thus secure for France, and ultimately perhaps for other countries, an abundant supply of many important articles of utility and luxury hitherto almost impossible to procure.

SOUTH KENSINGTON MUSEUM.

During the week ending 19th June, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,075; on Monday and Tuesday (free evenings), 3,147. On the three Students' days (admission to the public 6d.), 696; one Students' evening, Wednesday, 101. Total, 6,019.

ANNUAL STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31st MAY, 1858.

Dr.

	£ s. d.	£ s. d.	£ s. d.
To Subscriptions for the year ending 31st May, 1858:—			
From Members and Institutions in Union with the Society			3357 7 10
*Outstanding		1402 16 0	
Deduct due on former years	437 17 0		
Estimated not recoverable	192 19 9		
		630 16 9	
		771 19 3	
Life Contributions			156 8 4
To Dividends on Stock:—			
£5136 3s. 10d. Consols		149 11 10	
£388 1s. 4d. New 3 Per Cents.		11 6 2	
			160 18 0
To Interest on Deposit Accounts			18 19 7
To Special Objects:—			
Gutta Percha Committee		60 10 0	
Hobart Town Mechanics' Institution for purchase of apparatus		21 8 10	
The Prince Consort's Speeches:—			
Subscriptions received	435 5 3		
Do. outstanding	35 9 6		
		470 14 9	
*To meet balance of £75 4s. 11d. as on other side, there is Stock in hand—428 4to. and 1622 12mo. copies.			
T. Twining, Junr., in aid of the Working Classes Museum		250 0 0	
A Friend in discharge of the Cost of the Band at Conversazione at Brompton		15 4 6	
Sale of Microscopes		64 4 6	
Do. Dr. Booth's Lectures		23 4 8	
Do. Transactions		1 10 6	
Do. Catalogues of the Exhibition of Inventions		11 1 0	
Repairs to Photographic Collection		4 1 6	
P. L. N. Foster		0 1 0	
			922 1 3
To Special Subscriptions held in trust:—			
Examination Prize Fund received		190 0 0	
Do. do. outstanding		32 17 0	
To Prize Essay on the Financial Position of the Country, in addition to £210 included in last year's statement		78 15 0	
To Balance remaining from the Mulready Exhibition		240 0 0	
			£4615 15 0
To excess of Expenditure over Income			48 11 0
			£4664 6 0

* The Council have thought it desirable that this item should not be carried nto the outer column as in former years.

Cr.

		£ s. d.	£ s. d.
By General Establishment Expenses:—			
Rent, Rates, and Taxes		184 19 7	
Insurance, Gas, Coals, and House Charges		157 1 8½	
Salaries, Wages, and Commissions		939 4 0	
Postage, Stamps, and carriage of Parcels		139 2 10½	
Stationery and Printing (not including Journal)		169 9 11	
Advertizing		16 13 6	
			1606 11 7
By Special Objects:—			
Medals		12 9 0	
Distribution of Books		3 0 6	
Working Classes Museum		112 14 7	
Prince Consort's Speeches		545 19 8	
Two Conversazioni	£121 4 9		
Do. Cost of Band, discharged by "A Friend"	15 4 6		
		136 9 3	
			810 13 0
By Journal		881 12 3	
Less charged to Union of Institutions		176 6 5	
			705 5 10
By Exhibition of Inventions			115 6 1
By Union of Institutions, including Journal, Examinations, Postage, Stationery, Printing, and other charges			873 12 1
By Re-payment of Principal, secured by Debenture to Messrs. Twining		250 0 0	
Interest on Do. to February last		12 3 9	
			262 3 9
By Repairs and Alterations		65 18 3	
Library		28 0 4	
Manchester Visit		75 8 6	
Dinner, 1857		32 14 0	
Address to the H.R.H. the President		17 11 6	
Artistic Copyright Committee		30 4 6	
Gutta Percha Committee		0 6 6	
Hobart Town Mechanics' Institution		20 7 5	
Graham's Town Medical Society		20 2 8	
			290 13 8
By Mulready Exhibition		240 0 0	
Examination Prizes Advertised		228 0 0	
			£4664 6 0

BALANCE SHEET, 31st MAY, 1858.

Dr.

	£ s. d.	£ s. d.
To sundry Creditors, viz.:—		
To Tradesmen's Bills	748 12 4	
Fees to Examiners	177 5 0	
Salaries and Commissions	21 2 0	
		946 19 4
To Economic Museum		124 18 4
Gutta Percha Committee		60 10 0
Trust Liabilities in respect of Finance Prize Essay	288 15 0	
Marine Algæ Prize	70 0 0	
Examination Prize Fund	190 0 0	
Outstanding £32 17s. 0d.		
To Trust Liability in respect of Government Stock (Consols) held for specific purposes, as per contra, viz.:—		
Set apart to answer:—		
Swiney Prize	1333 6 8	
Stock Trust	100 0 0	
To Government Stock New 3 per Cent., set apart to answer Fothergill Trust	388 1 4	
		£1132 7 8
By Excess of Assets over Liabilities		3953 2 5
		£5085 10 1

Cr.

	£ s. d.	£ s. d.
By Cash in hand:—		
At Messrs. Coutts and Co.	257 7 10	
At Commercial Bank	115 6 3	
		372 14 1
At London and Westminster Bank, applicable to specific purposes	642 16 2	
By Consols, £3702 17s. 2d., at 97⅛		3610 0 0
By Subscriptions in arrear	1402 16 0	
Estimated as not recoverable to the amount of	300 0 0	
		1102 16 0
By Government Stock held in trust applicable to specific purposes, viz.:—		
Consols	1433 6 8	
New 3 per Cents.	388 1 4	
		£5085 10 1

(Signed) W. T. MACKRELL, J. GEORGE APPOLD, } Auditors.
P. LE NEVE FOSTER, Secretary.

Proceedings of Institutions.

Hastings.—The annual meeting of the Mechanics' Institution was held on 5th May last, at which there was a large attendance of members. George Scrivens, Esq., president, in the chair. The report presented by the Committee showed a decrease in the number of members during the year; the income, however, had been sufficient to meet the expenses, and there was a balance in favour of the Institution of £4 2s. 11d. The Committee reported that the following lectures had been delivered:—Two on "British India," by Wm. D. L. Shadwell, Esq.; one on "John Milton," and one on "Hugh Miller," by the Rev. H. J. Piggott; one on the "City Arabs," and one on the "Giant Killer," by the Rev. J. A. Blake; one on "Shells and their Inhabitants," by Mr. Clark; two on the "Writings of Chas. Dickens, with especial reference to 'Barnaby Rudge,' as illustrating the period of the Gordon Riots," by Mr. J. Banks; one on the "Genius and Oratory of Lord Brougham," by the Rev. J. C. Fishbourne; and a Concert by Mr. Albert Dawes; the attendance at the lectures had not on the whole, been encouraging; this was explained partly by the fact that they had not been delivered at equal intervals of time. Some of the students in the classes were mentioned by name as being worthy of recommendation, but the superintendents doubted if any would be likely to succeed in a competitive examination. George Scrivens, Esq., was re-elected president; F. North, Esq., M.P., W. D. L. Shadwell, Esq., Rev. J. H. Fisk, Messrs. Jas. Rock, jun., (mayor), C. J. Womersly, and W. Ransom, vice-presidents; T. S. Hide, treasurer; Messrs. J. Banks and J. Huggett, secretaries. Subsequently a special meeting of the members has been held, to consider the propriety of removing the Institution to more commodious premises, and after much discussion it was resolved to refer the subject to a Building Committee, who were authorised to negotiate with the promoters of a scheme for a large public hall, and to report to a future meeting. It appears that plans for a large central hall, capable of accommodating 1,000 persons, an arcade, rooms for the Mechanics' Institution, and another society, are nearly completed, and if approved by the shareholders of a company which has just been formed for the purpose of erecting the building, Hastings will possess the largest public room in this neighbourhood.

Oldham.—The eighteenth annual report of the Oldham Lyceum commences by alluding to the loss which the Institution has sustained in the death of its late president, James Platt, Esq., M.P., who had long given it his kind and liberal support. Other losses by death having been alluded to, the report goes on to say that last year has been, to some extent, an experimental year for the Lyceum. Enlarged from its former limited character to its present extended scale, it has been passing through a crisis both financial and otherwise. Its financial difficulties are not yet over, as its extended operations have entailed much greater additional expenditure than the increase in the revenue will cover. In every other sense its success has been quite equal to the expectations of the directors. It was predicted that, after the excitement consequent upon the opening of the new building had subsided, the interest taken in it by the working classes would disappear, and the number of members fall off to a very serious extent. The directors rejoice to find that this has not been the case to the amount that might have been expected, and that the average number of this class of members has been, during the year, three times as large as it used to be before the removal; whilst, on the other hand, they regret to say that the number of subscribers of the middle and higher classes has not been doubled. They, however, hope to see ere long a much larger proportion of the names of the tradesmen and manufacturers of the borough upon the list of annual subscribers. The accompanying returns show the condition of the various departments during the last year:—

Members.

	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Average during the year.
Females, quarterly	112	100	95	109	104
Males, ditto	400	329	295	399	356
Half-yearly	12	5	11	10	9½
Annual	101	109	111	100	105
Honorary	101	109	113	122	111
Life Members	44	44	44	44	44
Presentees	38	56	61	51	49
Total	808	752	720	835	778½

Classes.

The following shows the classes that have been in operation during the year, and the number of pupils on their respective class books. Two classes have been discontinued for want of members, viz., the mental arithmetic, and one for teaching singing upon the ordinary method. Three new ones have been formed, viz., a Latin class, an essay and discussion class, and a singing class upon the Tonic Sol-Fa system.

Classes	1st Quarter.	2nd Quarter.	3rd. Quarter.	4th Quarter.	Average during the year
Female Elementary	112	103	91	104	102½
Do. Sewing, &c.	55	50	39	45	47
Do. French	10	10	11	12	10¾
Male Elementary	234	215	179	262	222½
Do. Do. adults	56	36	40	48	45
Do. Grammar, No. 1	34	30	30	36	32½
Do. Do. No. 2	8	12	26	18	16
Do. Mental Arithmetic	13	0	0	0	13
Do. Algebra and Mensuration	12	11	12	12	11¾
Do. Geometry	10	6	6	4	6½
Do. Mechanical drawing	25	24	22	28	24¾
Do. French	12	15	13	10	12½
Do. Latin	0	7	0	14	10½
Do. Essay and Discussion	0	8	9	16	11
Tonic Sol-Fa Singing	0	0	0	107	107

The reports of the teachers appear to be generally satisfactory, showing that there has been upon the part of the pupils a great desire for self-improvement. As a whole, the directors consider that this most valuable department of the Institution has done a vast amount of good during the last year, and, taking into consideration the low charges at which its great advantages are offered, they look forward to continued success in the diffusion of sound and useful education. In order to keep down the expenditure in this branch, the class committee have sought to avail themselves as much as possible of gratuitous assistance in teaching, and they are much indebted to a number of gentlemen, who are each devoting one night per week to this purpose. In the club-room have been held several very agreeable and instructive soirées. The members are indebted to Mr. H. T. Robberds for three papers — respectively on "National Ballads," "Scotch Ballads," and "English Ballads," all of which he ably illustrated. A paper on "Poisoning with Arsenic," has also been given by Mr. John Noton; and one on "The Poetry of Akenside," by Mr. William Bodden. Several lectures and entertainments have been given during the year. With reference to finance, it has been found that the re-arrangement of the library, the compiling and printing of the catalogue, and the numerous expenses consequent upon transforming a small establishment into a large one, have added a great deal to the expenditure of last year, which will probably not be the case in future years; but the debt of £2000 which remains upon the building will, it is feared, be an incumbrance which the Institution is scarcely calculated to bear, unless a much larger number of annual subscribers can be obtained, or some equally certain means devised of permanently increasing the revenue. An effort has already been made to raise, by subscription, a fund for the liquidation of the debt, so as to give greater freedom to the operations of the Institution; but the sudden arrival of the late severe commercial panic has put it out of the power of the directors to conduct it to a satisfactory ter-

mination. However, as an earnest of their intention to rid the Institution of such an incubus, a number of the vice-presidents and directors themselves promised sums amounting to more than £300; and as soon as the improvement in business prospects will admit of its being done with any success, an appeal will be made to the public, when it is hoped that all lovers of education will assist in the work.

MEETINGS FOR THE ENSUING WEEK.

WED. ......Society of Arts, 4. Annual General Meeting.
THURS. ...Zoological, 3.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 17th June, 1858.

130. Bills—Friendly Societies Act Amendment (amended).
131. ——— Juries (Ireland) (No. 2).
132. ——— Trustees, Mortgagees, &c.
134. ——— Legitimacy Declaration.

Delivered on 18th June, 1858.

298. Duchy of Lancaster—Return.
299. Lunatic Asylums—Return.
329. Metropolitan Parishes (Roads, &c.)—Return.
342. Dunfanaghy Union—Returns.
126. Bills—Universities (Scotland) (amended).
138. ——— Protection of Female Children.
133. ——— Common Law Procedure Act Amendment (amended).

Delivered on 19th and 21st June, 1858.

310. Pilotage (Sunderland)—Correspondence.
338. Malt—Account.
335. Bridgwater Union—Return.
337. Workhouses—Return.
341. Sea Fencibles—Return.
345. National Portrait Gallery—1st Report of the Trustees.
290. Rating of Tenements—Returns.
135. Bills—Police Force (Ireland).
136. ——— Administration of Justice (Dublin).
139. ——— Government of India (No. 3).
140. ——— Reformatory Schools (Ireland) (amended).
144. ——— Art Unions Act Amendment.
145. ——— Stipendiary Magistrates.
147. ——— Railways Act (Ireland) Continuance.
148. ——— Portendic and Albreda Convention.

Portendic and Albreda—Correspondence.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 18, 1858.*]

Dated 14th May, 1858.

1090. J. Macintosh, North Bank, Regent's-park—Imp. in insulating telegraph wires.

Dated 19th May, 1858.

1114. J. Maudslay, Lambeth—An imp. in the manufacture of iron, and in the furnaces employed therein.

Dated 21st May, 1858.

1130. J. C. Brant, Surrey-square, Old Kent-road—Imp. in the permanent way of railways.

Dated 24th May, 1858.

1158. J. Scholfield and W. Cudworth, Rochdale—Certain imp. in machinery or apparatus for preparing, doubling, and twisting cotton, and other fibrous substances.
1160. G. Hamilton, Saint Martin's-le-Grand, and W. H. Nash, Poplar—Imp. in locks and keys.

Dated 25th May, 1858.

1162. J. A. Phillips, Earl's Court-terrace, Kensington—Imp. in the production of zinc, lead, copper, and silver, from ores containing these metals.
1164. G. W. Morse, Baton Rouge, Louisiana, U.S.—An imp. in fire-arms, and cartridges to be used therewith.
1166. C. F. D. Monnin, 26, Rue Vendome, Paris—Imp. in the manufacture of rivets, screws, spikes, pins, and nails, and in machinery for that purpose. (A com.)
1170. J. F. Belleville, Paris—An apparatus for indicating the work of pumps.
1172. W. E. Newton, 66, Chancery-lane—Imp. in breech-loading fire-arms, and cartridges for the same. (A com.)

Dated 26th May, 1858.

1174. F. A. Gatty, Accrington—Imp. in treating cotton or cotton yarns and fabrics when dyed with certain colours.
1176. J. Luis, 1B, Welbeck-street, Cavendish-square—An apparatus for baking firebrick clay. (A com.)
1180. J. C. Riddel, Belfast, D. Ritchie, A. Watson, and J. F. Allan, Glasgow—Imp. in cooking ranges and other fire-places.
1182. W. Bayliss, Wolverhampton—Iron tubular fencing, to be used for general fencing, as well as for the purpose of irrigation, and conveying water where required for agricultural or horticultural purposes.
1184. P. A. Fourgassié, Castres, France—An apparatus for clod crushing, rolling, weeding, and scarifying, clearing, or preparing land. (A com.)
1186. S. C. Lister, Bradford, and J. Warburton, Addingham—Imp. in spinning.
1188. F. Bouquié, Paris—Imp. in the manufacture of chains.

Dated 27th May, 1858.

1190. J. Schofield, Rashcliffe Lockwood, near Huddersfield, and G. Harling, Primrose-hill, in Almondbury, Yorkshire—Imp. in means or apparatus employed in weaving.
1194. G. H. Bovill, Durnsford lodge, Wimbledon, Surrey—Imp. in the manufacture of fuel.
1196. C. Clarke, Newmarket Union House, Exning, Suffolk—Imp. in machinery for dibbling wheat and other grain or seeds and manure.

Dated 28th May, 1858.

1198. S. Osler, South Quay, Great Yarmouth, Norfolk—The manufacture of fish into guano and food.
1200. T. Dunn and W. Irlam, Manchester—Imp. in machinery for altering the position of locomotive engines and carriages on railways.
1202. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An aperient biscuit. (A com.)
1204. J. F. Lackersteen, Young-street, Kensington—Imp. in machinery for cutting and splitting wood.
1206. A. Arnal, Rue du Faubourg St. Honoré, No. 191, Paris—A nose bag for horses.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1326. L. A. Bigelow, 133, High Holborn—Imp. in sewing machines (A com.)—11th June, 1858.
1333. G. T. Bousfield, Loughborough-park, Brixton—Imp. in marine steam engines. (A com.)—11th June, 1858.
1348. C. C. J. Guffroy, Lille, France—A new smoke-consuming apparatus, and also a new method of introducing the coal or fuel into it.—15th June, 1858.

WEEKLY LIST OF PATENTS SEALED.

June 18th.

3118. R. Furnival.
3119. W. Walker.
3127. W. Thrift and A. High.
3145. G. Bridge and J. Hamer.
3161. G. Burley.
3164. B. Burleigh and F. L. Danchell.
3193. R. Harmer.
476. H. Deacon.
553. J. Webster.
828. A. P. Price.
830. A. P. Price.
857. E. K. Calver.
858. J. Armstrong.
874. J. Copcutt.
882. S. Clegg.

June 22nd.

3142. M. Landou.
3146. D. J. Crossley.
3147. T. Landi, and C. Falconieri.
3150. A. F. Kynaston.
3151. J. Moss, T. Gamble, and J. Gamble.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

June 14th.

1367. H. Bridgewater.
1416. W. E. Newton.

June 16th.

1382. H. Bessemer.
1384. H. Bessemer.
1385. T. Blanchard.
1393. J. H. Johnson.

June 17th.

1379. L. H. Real.

June 18th.

1398. J. Macintosh.

June 19th.

1418. J. L. Jullion.
1432. O. R. Chace.
1445. I. J. Silbermann.
1459. B. Bonnet.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4096	June 10.	Portable Backgammon, Chess, and Draught Board	J. Jaques	102, Hatton-garden.
4097	,, 10.	Tubular or Pipe Steam Boiler	S. Cartwright and R. Ryall	Louth, Lincolnshire.
4098	,, 15.	Needlecase or Pincushion	J. Morris and Sons	Astwood Bank, near Redditch.
4099	,, 17.	A Stay Fastening or Busk	J. F. Elwall	1, Albert-terrace, Royal-road, S.
4100	,, 18.	Improved Tumbler Cart	Fowler and Fry	Temple-gate Factory, Bristol.
4101	,, 23.	The Perfect Union Joint	E. Russell	87, Holborn-hill.
4102	,, 23.	A Hot Water Cistern for domestic purposes	W. Wilson	50, King-street, Manchester.

Journal of the Society of Arts.

FRIDAY, JULY 2, 1858.

SEVENTH ANNUAL CONFERENCE.

Thursday, 24th June, 1858.

The Seventh Annual Conference between Representatives from the Institutions in Union and the Council of the Society, was held on Thursday, the 24th inst., at the Society's House, in the Adelphi. C. Wentworth Dilke, Esq., Chairman of Council, presided.

At the conclusion of the Secretary's report to the Council, read to the Conference, and given in the last number of the *Journal*,*

The Chairman said, before they commenced the discussion of the subjects contained in the circular which had been issued to the Institutions,† he wished to allude to one or two points which might have some effect upon the discussion. In the first place he would refer to the circumstance of one Local Board having failed to carry out to the strict letter the arrangements of the Council with respect to the recent Examinations. The Council felt that it was hard upon the Candidates that they should suffer from any neglect on the part of the Local Board, and although, under the circumstances, it would not be just that certificates or prizes should be awarded to them, yet as, under ordinary circumstances, two of these candidates would have been entitled to prizes respectively of £5 and £3, those sums would be respectively given by the Council to them, in the shape of presents, and not as prizes. They had heard from the report which had been read that the present Council had taken steps for early submitting to their successors in office the programme and rules for the next year's Examination. So much difficulty had arisen on former occasions from a late publication of the programme, that the present Council would leave on record an expression of their opinion as to the desirability of its being sooner published in future. In preparing this programme for next year, the Council had suggested certain alterations in two or three points which appeared to them of importance; first, as to the number of subjects which the examination should include. On the last occasion there were twenty-six subjects, but on carefully considering the question, the Council came to the conclusion that it would be wise to remove from the list the drawing—both free-hand and mechanical, inasmuch as government now afforded every facility for testing the progress and proficiency of students in that branch in every part of the country, as systematically as could be done under the auspices of the Society. In place of drawing, the Council thought it would be advisable that the theory of music should be inserted. They also considered that geometry and mensuration should form one division instead of two, as at present. He would now call their attention to the first subject which had been put forward for discussion by the Conference. This was—

"At what season of the year can the Final Examinations be best held? At Easter, Whitsuntide, or at what other period?"

He might mention that in Lancashire, Whitsuntide—being the season of general holiday amongst the operative classes—was found to be an inconvenient time. In the original selection of that period, however, it had been thought that holding the Examination during the holidays would trench less upon the time and earnings of the working men than any other arrangement. But in Lancashire especially, Whitsuntide was a time for the meetings of benevolent societies and other important bodies, and he believed that this had affected the return of the number of candidates from Manchester. Under those circumstances it was thought best to consult the opinions of the delegates on the subject. With regard to the time allowed to elapse between the preliminary and the final Examination, it was thought by some members of the Council that four weeks was sufficient. He (the chairman) was in favour of the longer period of five weeks, but that was a point in which he would yield to the opinion of the majority.

Mr. James Hole (Yorkshire Union of Institutions) wished to ask if this was a proper time to introduce a resolution upon the subject of Examinations with which he had been charged by the institutions which he represented, and which held a different opinion as to the number of centres of Examination to that which had been expressed in the report just read. It was a fundamental question affecting the Examinations, and he thought his resolution would be properly discussed before they decided the first question upon the paper as to the period to be fixed for the Final Examination. The experience in Leeds, and he believed throughout the whole of Yorkshire, had been unfavourable to the large number of centres of Examination that had been established under the terms of the last programme issued by the Council, and he was instructed to propose that the centres should be very much diminished.

The Chairman thought it was immaterial when this resolution was brought forward, but he could not but feel that it depended very much upon the localities themselves as to the number of Local Boards they found it desirable to appoint. The Council had certainly seen with regret that it had been found necessary that two Local Boards should be established both at Leeds and at Sheffield.

Mr. Hole said the resolution he had to propose was this—

That this meeting is of opinion that the present system of Examinations of the Society of Arts, conducted through Local Centres, would be improved by introducing the following changes, viz.: 1st. That to the Local Boards should be attached Examiners delegated by the Society of Arts. 2nd. That for this purpose it is essential that the centres of Examination should be reduced in number, and not exceed five. 3rd. That the Examinations be oral as well as by written

It would be recollected that at a meeting held in that room last year, Mr. Baines attended and urged his views on this question, but the opinion of that meeting was so decidedly in favour of the system adopted in the present year, that the Yorkshire Union, who were anxious, as far as possible, to carry out the views of the Society, determined to give the system a fair trial, and used every exertion to carry it out in the best possible manner. That meeting might not be aware that the Yorkshire Union comprised upwards of 20,000 members of Institutions, and he thought the views of so large a body were entitled to some attention. As a member of one of the Local Boards at Leeds, he begged to state that whilst, in some instances, the attendance of the Examiners was required for only two or three Candidates, there was another Local Board within a short distance of them similarly occupied, and he could not but feel that this was a very unnecessary waste of the time of the Examiners, and under such circumstances it was extremely difficult to conduct the Examinations in a really satisfactory manner. Besides, it seemed too bad to ask gentlemen of standing and education to give up their time merely for the examination of two or three Candidates. He was therefore of opinion that the Society of Arts should in some way control the appointment of the local boards, so as to limit their number to such an extent as to secure a fair number of candidates for each.

* See page 492.
† See last No. of *Journal*, p. 494.

Another thing he thought detrimental to the present system was the form in which the examinations were conducted. Under the present system of written papers it really required no great ability on the part of the Local Board to conduct the Examinations, and he thought the form should be so modified as to render necessary the attendance of men of high intellectual character. This would tend to make the examinations more valuable and more satisfactory. Under the present system it was sufficient to have persons in the room to prevent collusion amongst the candidates. If candidates knew that their examination was to be superintended by persons of high intellectual standing, they would consider it a higher distinction to work their papers in the presence of such men. He quite saw the force of the objection raised against the sending down of examiners from London into the provinces, but he thought a plan might be devised for deputing one or two gentlemen from the Society of Arts to superintend and control the examinations, upon a diminution being made in the number of centres, as proposed in the resolution he had submitted. He was happy to find that Yorkshire had taken a fair proportion of the awards in the recent examination, and he thought, both in respect of the magnitude of their operations and what they had done in the matter of the examinations, the Yorkshire Union was entitled to some weight on this subject. He therefore begged to move the resolution which he had read.

Mr. Rumney (Manchester Mechanics' Institution and Local Board) seconded the resolution. His experience had been similar to that of Mr. Hole. The resolution, he thought, would be a valuable one. He preferred oral examinations by the Local Boards to an examination exclusively by papers, and in another year he anticipated similar difficulties to those which had been experienced this year, and which had been referred to by Mr. Hole. In Manchester they had as examiners professors of Owen's College and another similar establishment, whose only duty was to watch for three hours over a few candidates, like mere policemen, and in some instances over a single candidate. He thought they would have a difficulty in securing the services of such gentlemen again for such an office. With regard to the time for the final examinations, he thought the examiners were as anxious to be in the country during the holidays as the pupils themselves. He was in favour of limiting the number of centres, and sending down persons from London to supervise the examinations. This could be done without great expense. He regretted the proposed change in the programme, as mentioned by the Chairman, with regard to the drawing. He believed another year would furnish a very large number of candidates in that branch in Manchester. They had already 200 young men two or three nights a week in the drawing classes, and it appeared they excited more interest than almost any other. With regard to the time for holding the final examinations, he would say, that for the district of Manchester, a more inconvenient time could hardly be selected than Whitsun week. Probably Easter would be found more convenient.

The Rev. Canon Girdlestone (Bristol Athenæum), as chairman of the Local Board of Examiners, had found no difficulty in associating with him a large and competent board, comprising representatives of all classes, churchmen, dissenters, mercantile and professional men. He did not think, as far as he had communicated with persons in his own neighbourhood, that the change proposed by Mr. Hole would be acceptable. With regard to the other part of the question he hoped, for his own part, that there would be no further limitation of the number of centres of examination. He thought the more they were multiplied with discretion, the better, of course always excepting two centres in one place.

Mr. Andrew Murray (Portsea Watt Institution) formed one of the Board of Examiners there with only two candidates, but he agreed with the last speaker that no difficulty was experienced in finding gentlemen of good standing and high abilities to act as Examiners. With regard to the towns in the south of England, it was extremely undesirable to dimish the number of centres, so as to impose upon candidates the expense and loss of time in attending examinations at other places. In the populous towns mentioned, he could not understand how they could have any difficulty on the subject of examinations; with the smaller towns it might be different. He had no doubt, if the larger and more flourishing Institutions, or Unions of Institutions, would guarantee the expenses of Examiners from London, the Society would be ready to furnish them. As far as his experience of the present arrangements went, they had been found to act very well, and he wished to see no change in that respect.

The Chairman said it might be well that he should state the actual facts as they had occurred in two cases. When he visited Sheffield, he found that they had not been able to send any candidates to the London Examinations, on account of the distance and the expense; they had, however, been able to avail themselves of the Huddersfield Examinations to some extent, though even in this case the distance was found to be a serious drawback. A short time afterwards, some members of the Council attended a meeting at Brighton, at which there were present representatives of Institutions in towns on the south coast. When it was proposed to form a general Local Board at Brighton, to include these towns, the delegate from Lewes wished the meeting to understand that a Local Board at Brighton was practically no benefit to Lewes, although it was a town on the same line of railway, and within an easy distance. He could not but think that the Yorkshire Union considered the matter too exclusively from their own point of view. It should be remembered that, although it included, as Mr. Hole had observed, so large a number of members, this Union only contributed two guineas to the funds of the Society of Arts. When they considered the fact that two of the first prizes at the last Examination were gained by candidates from Banbury and Berkhampstead, it became an important consideration where such candidates could go for examination if the centres were diminished. With regard to sending Examiners from London, this had been tried at Huddersfield last year, and great difficulty was then experienced in getting even a few Examiners to go down to that place. The Board of Examiners determined that five of of their number should go to Huddersfield, and this ended in only four going down, and a local gentleman acting as the fifth. If that was the result with one centre, he need not say what would have happened if six centres had been attempted, and even with this number they could not have accomplished the great end for which Examinations were established.

Mr. T. A. Hedley (Banbury Mechanics' Institute) said the present system had worked well in his locality, two Candidates from whence had received first-class certificates and two prizes, and he believed on the next occasion they should have a larger number of Candidates. Oxford would be the nearest centre for Banbury, but even that would be attended with inconvenience.

Rev. J. H. Ryland (Bradford Mechanics' Institution), as president of his Institution, had taken part in the late Examination, he hoped with some success. He did not see the force of the argument that had been employed, that under the present system of Examination by papers there was a difficulty in getting men of a high intellectual standard to act as Examiners. He considered it a high honour to be asked to act as an Examiner, and there were others of the most distinguished attainments who thought the same; if it was only to watch the diligence of the young men at their books, he considered it a duty not unworthy of men of the highest education. This first year of the system must be regarded as an experiment. He had no doubt, on a future occasion, that the small number of candidates spoken of as appearing at some centres,

would be absorbed in some neighbouring and convenient centre. He considered the Society acted wisely in leaving as much discretion as possible to the authorities in the provinces. He thought the more centres they had the better, consistent with convenience. He expressed a strong opinion at the annual meeting held at Selby, as to the mode of Examination, where he knew that there was a general opinion in favour of oral combined with written Examination. In that opinion he did not share. A system of oral Examination could hardly be conducted by provincial Examiners, and must be confined to the representatives of the Society in London, and hence it would be open to the objection of exclusiveness; for his own part he should certainly hesitate to take upon himself oral Examination in his own institution. If oral Examination was to be admitted, he thought it ought only to be under Examiners sanctioned by the Society of Arts, which, of course, would involve the necessity of delegates from the Society for that purpose. He thought they had had hardly sufficient time to test the efficiency of the present system, but to his own mind it was most satisfactory. The desire which seemed to prevail in some quarters for oral Examination, would appear to have induced the resolution which had been proposed for the diminution of the number of centres. For his own part he had great confidence in what had already been done.

Mr. JAMES SPENCER (Greenwich Society for the Diffusion of Useful Knowledge) agreed with the mover of the resolution as to the desirability of reducing the number of centres of Examination. This had been a year of experiment, and the fact that it was such ought to induce them to ask themselves the question whether it was probable that in another year they would get the same class of gentlemen to act as the Local Boards of Examiners. He did not think persons of high education would be willing to attend the examination of two or three candidates. The question would naturally be asked whether the results were worth the time that was spent upon them. He believed that the candidates felt very little confidence in Examinations carried on according to the present system. Under the former system no one knew of the candidate's want of success except the Examiners themselves, but under the present system he apprehended a degree of diffidence would be felt, lest the failure of any candidate should be exposed to the world. He hoped some steps would be taken by the Council to give the Local Boards as high a character as possible. He thought it was a small compliment to say that a candidate would not travel twenty miles to get a certificate; and seeing that the certificates of the Society had been the means of advancing the position in life of the possessors of them, young men would, in his opinion, consider it worth their while to go after them. Those who sought distinction would husband both their time and their resources to obtain these valuable certificates.

Rev. J. R. CRAWFORD (Berkhampstead Local Board) said, as reference had been made to the Institution which he represented, he felt himself called upon to offer a few remarks upon the present subject, in opposition to the views of the delegates from Manchester and Leeds. He felt that if any innovation of the kind suggested by Mr. Hole were introduced, it would be at the expense of the small Institutions, and for that reason he objected to the resolution. In his own little village they had some ten candidates—young men who were employed in business all the day, and attended classes for evening instruction, in teaching which he was assisted by his coadjutor of the Grammar School. He thought if the pupils had to travel a distance to be examined, there would be a falling off in the number of candidates, although it might be an advantage to such places as Leeds and Manchester. He hoped if any modifications were introduced for the sake of the large towns, there would be no interference with the present system as regarded the smaller towns and villages, because he thought if such a change as was suggested was brought about, the smaller institutions would be sacrificed.

The CHAIRMAN remarked that the difficulty raised by the delegate from Greenwich as to procuring the attendance of the Local Board, would be met by the proposed alteration of the time-table. The Council felt that the time for the preliminary examinations was too extended, and hence a limitation of this had been suggested. It was felt that the Local Boards were called upon to give up more time than could fairly be expected.

Mr. T. J. PEARSALL (London Mechanics' Institution) expressed his opinion that there would be no lack of competent examiners even in cases where few candidates presented themselves. He strongly recommended the Society to persevere in the cause they had so well begun, and, with regard to oral examination, some method might be hereafter adopted to meet the wishes of those who desired it. He fully subscribed to the opinions expressed as to the disadvantage of compelling candidates to travel to a distance to be examined, and on that account he thought it undesirable to diminish the number of centres of examination.

Mr. HARRY CHESTER remarked that this subject had been very fully discussed, and he now begged to offer a very few observations upon it. The whole tenor of Mr. Hole's resolution was the reduction of the number of centres to 5.

Mr. HOLE said he was not particular as to that precise number.

Mr. CHESTER continued:—If this movement was to succeed, it was necessary that the Institutions should have confidence in the governing body of the Society of Arts. The Council had considered this subject, they had discussed it in all its bearings, and seeing their way to carry out a certain object, they did not wish to turn aside from pursuing the only course which they believed they could take, in order to adopt some other plan which they were all but certain would not succeed. If any other body could do this better than the Society of Arts, he, (Mr. Chester) said, let them do it. What was the object they had in view? To improve the education and thereby the well-being of those classes of the community who were connected with Mechanics' Institutes, Athenæums, and Peoples' Colleges throughout the country. A small knowledge of the condition of that class of the population must lead them to see that the faculties of locomotion were not within their reach. If the difficulty occurred of having only one candidate in one locality, it would be easy to transfer that candidate to some other Local Board; that had been done in some cases, and in one instance the candidate had obtained a prize. The Society of Arts above all things could not consent to reduce the number of centres. They wished to have the largest number of centres that the different localities could manage. The map which he held in his hand showed the places in which Local Boards were already established, and they extended over nearly the whole of England, and penetrated even into Wales. They had had examinations at 32 different places. He agreed with Mr. Hole that it was a pity that at Leeds and other towns there should be two boards. It would be better, for the efficiency and good feeling which ought to arise out of operations of this kind, that in those places there should be but one Local Board. The difficulties which separated persons on account of religious distinctions ought not to be allowed to operate, as they were dealing not with the process of education, but with its results. For his own part, his hope was, not that they should reduce the centres from 32 to 5, but that next year they might get from 32 to 50, 60, or even a larger number; he should not be satisfied until he saw this system in operation throughout the whole of the United Kingdom, because he was sure that if it was carried out, it would give the greatest possible impetus to education. All who were acquainted with the details of the subject knew that the master

difficulty was the want of appreciation of education. They wanted masters and means to continue education after the time of leaving the elementary schools. This was the first year they had tried this particular method, but he thought it was capable of arriving at great things. He could not think the meeting would accept this resolution, for a general desire had been expressed by most of those who had spoken that the centres should be increased rather than reduced. As to the difficulty of getting competent Boards of Examiners to act, when the number of candidates was small, he thought that objection had been very much got rid of by the speakers who had preceded him. The way to get rid of the difficulty was to extend the Local Boards, and make them permanent throughout the year, so that by counsel, by inspection, and by frequent examination, they might assist materially in promoting classes for instruction in the several Institutions.

Sir Thomas Phillips (Newport Athenæum and Mechanics' Institution) could not help feeling that this question was at the base of the whole of the operations of the Society. If they passed a resolution to limit the number of centres of examination in the mode suggested, the object of the Society to stimulate—to excite wholesome love and wholesome desire to promote education throughout the provinces must fail. It was all very well to say that young men possessing the ability to rise would make the struggle and undertake the efforts necessary to do so; but ought the Society to expose any one to additional labour by limiting the centres, and compelling candidates to travel long distances, under the embarrassing circumstances of constant employment and limited time? He held that one great good to be done by the system was this—to multiply these local boards, these voluntary associations, who would themselves feel, and would impress on others, the value of education, and it was by multiplying rather than limiting the operations of these boards that the Society would do most good. It certainly was not for the Society to discourage the formation of Local Boards wherever circumstances enabled them to be established, and it was for the localities themselves to determine whether circumstances rendered it possible that such associations should be formed. It was somewhat remarkable that the objection to the present system should come, not from the rural districts, or places with a limited number of students, but from the great hives of industry—from those places where there were the greatest number of students—that they should be opposed to the distribution of these Local Boards amongst the rural districts, and should apparently wish to confine them to their own localities. They said, in fact—"Give *us* Local Boards of Examiners, but do not distribute them through the length and breadth of the land." Whatever might have been the difficulties in this experiment, the attempt to correct them in the manner proposed would, he thought, impair the usefulness of the Society, and he hoped that no expression would go from this conference that it was their desire to limit so seriously the area of the Society's operations.

Mr. Alexander McIvor (Leeds Mechanics' Institution and Local Board) thought the speakers on this subject had overlooked one important element in Mr. Hole's proposal, which was, that the Council of the Society should be represented by one or more examiners at each of the proposed five centres. He knew that this was regarded by many as very important; and though it was desirable, on the one hand, not to check the formation of Local Boards throughout the country, yet, on the other hand, it was necessary to prevent an unnecessary multiplication of them. It was easy to find in populous districts efficient men to act as examiners. Owen's College contained men of as high reputation as any of the colleges of the metropolis, and professors of other provincial colleges were men of great eminence. The Leeds Board of Examiners was composed chiefly of professional men, chemists, physiologists, teachers of natural science, and persons of high professional standing. He thought that whilst the results might be dealt with by the Society, the process of education should form one of the functions of the Local Boards, who should exercise constant supervision over the classes in their respective institutions. He thought it was a matter of pride and social distinction, that a person should be regarded in the locality as an examiner on the part of the Society of Arts. He was satisfied that if the composition of Local Boards were properly attended to, it would be a matter of high interest to be engaged in working out so excellent a scheme.

Mr. Henry Cole, C.B., would venture to take the opinion of the meeting upon a resolution completely opposite to that proposed by Mr. Hole. He begged to move as an amendment:—

That the Conference is of opinion that it is for the benefit of those for whom the Society of Arts' Examinations are intended, that the system of Local Boards should be extended throughout the Society's Union, wherever the locality can make satisfactory arrangements for the working of such Boards.

They often met with strange paradoxes; and to have, as they had on this and former occasions, the impersonation of extreme voluntaryism contending that they could not do their own work, but must have extrinsic aid, was one of those strange contradictions that were sometimes met with in life. If he had been asked to fix upon any place where he would suppose they could do their own work, it would of all others have been Leeds; yet the representatives of Yorkshire came up to this conference with a proposition which he could not but say was rather selfish—which was entirely for the benefit of that district, and tending to the injury and disparagement of such smaller places as Pembroke and Berkhampstead, and a stultification of the principle, so much contended for in the present day, that education should be made voluntary, and that they should have as little centralisation as possible. He believed the feeling of the meeting was that it was the business of this Society to try and stimulate a feeling throughout the country that people should do their own work, and to that end it was necessary to have as many centres as possible. If he wished to run into an opposite exteme, he should say it was expedient to have not merely 50 but 500 centres, but it was the business of the Society to recommend only that which was justified by experience. He thought this proposition for five centres an undesirable one, and with that view he proposed the amendment which he had read.

Mr. Stephen Baldock (Barnet Literary Institution) having intended to move a resolution similar to that submitted to Mr. Cole, had great pleasure in seconding the amendment. The resolution he had intended to propose set forth that the meeting entertained the fullest confidence in the manner in which the Council had proceeded in the matter of the Examinations.

Mr. Barnett Blake (Yorkshire Union) contended that the resolution of Mr. Hole was opposed upon fallacious grounds. It was not intended by it to limit the means of examination or the local influence which gave value to those Examinations. He could state, from a practical knowledge of the working of 120 Institutions, how the matter stood. Although at the time the Council determined upon the change in the mode of examination, the Yorkshire Union expressed an opinion as to the value of oral examination, they nevertheless lent their aid to make the present system as efficient as possible. The whole of Yorkshire was mapped out, showing the places best adapted for centres of Examination, and 12 were suggested for Yorkshire, and of that number 9 were fixed upon. The Institutions were advised as to how they had better form Local Boards, in order that every success should attend the scheme. In Halifax they had no fewer than three Local Boards.

A Delegate inquired how that happened.

Mr. Blake replied, simply because there was no control over them, and the real fact was, that there was

some little rivalry on the two sides of the water at Halifax. Were those bodies to unite in Leeds and Halifax, as they did in the first instance at Sheffield, it would give them a status and a position, and all foolish rivalry would cease. The feeling amongst some of the largest educational establishments in Yorkshire was that the departure from the oral system deprived those Examinations of their greatest value. But then it was objected on the part of the Society that it was impossible to extend the system of Examination if the personal attendance of a Board of Examiners from London was called for, and it was indispensable to have uniformity of system. He contended that there was not in the resolution of Mr. Hole the paradox which Mr. Cole had represented as proceeding from the advocates of voluntaryism. The Yorkshire Union did not wish to deprive other places of benefits which they claimed for themselves. With reference to the time for holding the final Examinations, he would suggest that this should be about the first week in April. With regard to the remark of the chairman, that from the Yorkshire Union the Society only received the ordinary subscription of two guineas a year, it was to be borne in mind that a great many members of that Union paid their 2 guineas besides, and the Union would be happy to make the subscription 20 guineas if it were required, in order to make the Examinations really of value. What he felt was, that they required the presence of at least one gentleman deputed by the Society of Arts to superintend the Examinations, and to see that the rules of the Society were strictly adhered to. If this were done he felt that a higher value would be attached to the Examinations.

The Hon. and Rev. Samuel Best (Hants and Wilts Adult Education Society) had pleasure in supporting the amendment of Mr. Cole. He represented upwards of 100 institutions in the southern parts of England, which were probably almost unknown to the gentlemen of Yorkshire, and they could, therefore, expect but little of their sympathy. He most earnestly hoped the plan now adopted would not be interfered with, and that oral examination, which was found practically to be impossible, would not be returned to. If it were, he believed it would be destructive of the whole efforts of the Society, and would defeat what he believed to be the really successful mode of examination that had been adopted. What they wanted in carrying out the present plan was not men of extraordinary abilities, but men of honesty and sound integrity, to see that the examinations were carried out in accordance with the regulations laid down by the Society. Having conducted this sort of examination for the last three years, he had no hesitation in saying that he found no difficulty in getting persons to act as examiners in the various institutions with which he was connected. He believed some hints had been taken by the Society from the working of the Hants and Wilts Association with respect to the examinations. He felt called upon to oppose in the strongest manner the proposition which had been made for reducing the number of centres of examination. If that resolution were carried, such places as Lymington and Berkhampstead would be blotted out of the map, and yet they were places of considerable importance in connection with this educational movement, and candidates from them had distinguished themselves. He had great pleasure in supporting the amendment proposed by Mr. Cole upon the ground that he should be extremely unwilling to cripple local exertion in any way.

Mr. Hole (as the mover of the resolution) replied upon the discussion. He said most of the remarks that had been made had arisen from a misconception of his intentions. He did not appear as the representative of the voluntary system, but, in the present instance, he rather took the opposite side. His (Mr. Hole's) main argument on this subject was, that in proportion as they increased the number of centres, they diminished the importance of the Examinations. Last year they had two centres, this year there were 58, but of 16 out of that number they had heard nothing at all. They had therefore only 32 effective centres. At the two centres last year they had 220 candidates, whilst at the 32 centres they had only 299 candidates.

Mr. Chester remarked that they had this year excluded pupils of schools. The total number of candidates from Institutions was much greater this year than last.

Mr. Hole contended that if the number of candidates had been in the ratio of the addition to the number of centres, there ought to have been at least 500 or 600 candidates this year. With regard to the resolution he had proposed, he did not wish to bind himself as to the precise number of centres. He held that the number of centres ought to be that which would command the greatest amount of influence. He was in favour of few centres and properly qualified Examiners at each centre, and he thought such a plan would command an amount of success which they would vainly hope for under the present system. The experiment had been fairly tried this year, and he thought the results were not such as ought to be satisfactory to them. They must feel that it should not be allowed that any persons who chose should set themselves up as Boards of Examiners. He believed the expense of sending down representatives of the Society at the Examinations, with a limited number of centres, would be amply compensated by the results that would follow such a plan. He had no doubt the Yorkshire Union would readily pay £10 or £20 towards the expenses of gentlemen in whom they had confidence to conduct the Examinations. It was not his intention obstinately to contend for oral Examination, but he submitted that if they wished for success in this movement, they must decrease the number of centres, and must make the Examinations of the highest possible character.

The Chairman said they had had some little experience to guide them during the last 12 months, as regarded the Oxford Examinations. Although they charged an examination fee of 30s. to each candidate, which would naturally tend to limit the number, yet it was found necessary to establish 12 centres of Examination, which he thought was an argument very strongly in favour of increasing rather than diminishing the number of centres in connection with their own scheme.

The Chairman then put the amendment of Mr. Cole, which was carried by a very large majority.

I. & II.—Period for the Final Examination.

The Chairman called the attention of the Conference to the first question proposed for discussion by the Council, viz., the season of the year at which the Final Examinations could be best held? He should be glad to receive the opinions of the delegates on this subject, as the Council had no other feeling than to consult as far as possible the convenience of the Institutions.

Several Delegates offered suggestions as to the most suitable period. It was argued that Whitsuntide had generally been found an inconvenient time, owing to its being a season of holiday making, and it was submitted that the already too restricted opportunities of recreation for the working classes ought not to be still further curtailed. Various periods between Easter and Whitsuntide were suggested. It was urged that it would be desirable to hold the Examination as early as possible in the spring, and as soon as possible after the period of closing the classes which were usually carried on during the winter months.

Mr. Chester remarked that connected with this question was that of the periods into which the final examinations should be divided. If they reduced those periods, it would be easier to determine the time of year at which the final examinations should be held. This year it had been found necessary to extend the periods over the whole of the week, because the time tables could not be published until they knew the number of candidates to be examined in each subject, but in future the time tables

would be published with the programme, and the students could select the subjects on which they wished to be examined, and the time could be arranged accordingly. It was intended that no candidate should be examined in more than three subjects in one year, and he thought there should not be more than three periods, and if found advisable he would suggest the morning, afternoon, and evening of one day for the different subjects, when the whole business would be got through with only one day's absence of the candidates from their ordinary avocations.

The Delegates from Leeds (Young Men's Christian Institute), West Brompton, Greenwich, Battersea, and Crosby Hall, expressed an opinion favourable to evening examinations, as best suiting the convenience of the candidates in respect of their employment.

The Hon. and Rev. Samuel Best, on behalf of the agricultural districts which he represented, suggested that the periods of examination should be extended over as short a time as possible.

Mr. Thomas Sopwith, F.R.S. (Allenheads Library and Institute and Durham Mechanics' Institution) suggested that the examinations should be held as closely as possible upon the termination of the period most devoted to study—the winter months. He did not approve of holding them at a period of national holiday. He considered holidays were as essential to the working classes as study. They had too few intervals of rest, and he should be unwilling to see the established holidays interfered with.

Mr. Barnett Blake, Mr. Buckmaster, the Rev. A. W. Worthington, and other delegates expressed themselves as favourable to evening examinations.

The following resolution was then agreed to:—

That the Examinations be held in the evening, but that the number of such evenings be left in the hands of the Council to arrange.

On the motion of Mr. Spencer, seconded by Mr. McIvor, it was resolved—

That the period of the year for the Final Examinations be some convenient week, to be fixed by the Council, between Easter and Whitsuntide.

III.—Minimum Age of Candidates.

The Chairman then introduced the next subject, viz., "whether the present *minimum* age of candidates, 16, shall be retained, or whether it shall be raised to 17 or 18."

A general opinion having been expressed in favour of retaining the minimum age of 16, this was, after a brief discussion, unanimously agreed to.

IV.—In what Manner the Local Boards can beneficially co-operate with the Institutions in forwarding the Preparation of their Candidates for Examination.

Mr. McIvor said, at the present time the Local Boards were distinct bodies from the managers of the Institutions, and he thought it important to bridge over this separation between them. He thought this was a point which might usefully be suggested to the Institutions at large, that they should establish some definite connexion between themselves and the Local Boards. The committees of Mechanics' Institutions were chosen for the most part from persons who were competent to deal with the general business of the Institutions, but to deal with educational matters required special culture, and for that reason it was important that the Local Boards, who were composed of men of high education, should be in intimate association with the committees of the institutions. He therefore begged to propose the following resolution:—

That it be recommended by this Conference to all the Local Boards that they put themselves into communication with the directors of the Institutions with which they may be severally connected, in order to assist the formation or the continued action of classes for the preparation of candidates for the Society's Examinations.

Under the present system, the Local Boards were not recognised by the Committees of Institutions, and the footing on which those Boards acted was insecure. He considered that they ought to have a recognised right to visit and make suggestions, and generally to work in harmony with the committees in promoting the welfare of the Institutions.

The motion was seconded by Mr. Spencer.

The Chairman remarked that the object of the resolution was evidently to constitute the Boards of Examiners as more generally recognised bodies amongst the institutions with which they were connected; that in fact they should have some function beyond that of mere temporary Examiners, that they should visit, stimulate, and stir up the classes in the Institutions.

Mr. Blake said this resolution opened up the whole question of Local Boards. What was required was, that there should be a more special recognition of those bodies on the part of the Council, and that degree of control which should prevent the multiplication of Local Boards in the same town. He thought that examiners should be appointed with the approbation of the Society of Arts. A more systematic organization of the Local Boards might enable them to get over some of the difficulties mentioned in the early part of the discussion, and such places as Leeds, Halifax, and Bradford might have permanent Local Boards, who could be in regular communication on all matters of importance with the Secretary of the Society.

Rev. J. H. Ryland thought the sole connection should be between the Committees of the several Institutions and the Society of Arts, and that through that connection only the Local Boards should exist. He thought this was a matter which might be left to the good sense of the several institutions. At Bradford they had appointed gentlemen to form the Local Board, which had worked very satisfactorily.

Mr. Chester said the question under discussion was whether the Local Boards could assist the candidates in their preparation for Examination. He hoped that what had been said that day would strengthen the hands of the council in recommending that in such towns as Leeds, where there were two Boards, they should unite and have but one. It was quite competent for them to pass a resolution that the conference is of opinion that there should be only one Local Board for each town, although it could not be made binding. It was the hope of the Council that in each year the previous examinations would become more and more important, and then he believed men, however highly educated, would feel that it was an honourable position to preside over these examinations. The Previous Examinations, to any extent the Board thought necessary, might be conducted orally, although this could not be introduced into the Final Examinations, and in that respect the wishes of the Yorkshire Union might be partly met. This resolution could only go in the form of a suggestion to the Local Boards in their preparation for the work that they would afterwards have to deal with.

Mr. F. Talbot (Birmingham, Messrs. Chances' Library and Reading-room) suggested that great service could be rendered by the Local Boards by quarterly examinations of the students in the Institutions. By that means the candidates would gain confidence.

Mr. Edwards (Newington Tailors' Labour Agency Literary Institution) thought that, as far as possible, the Local Boards should be permanent, and not merely appointed for any given Examination, and then they might hope to find a reciprocal interest springing up between the Institutions and the Local Boards in aiding the classes and promoting the Examinations. He submitted that the functions of the board should not cease as soon as the business of the examination was terminated.

Mr. Pearsall thought it within the province of the Local Boards to exercise a kind of surveillance over the educational proceedings of the Institutions.

Mr. H. Woods, M.P. (Wigan Mechanics' Institute),

thought it better that the proposed recommendation to the Local Boards should emanate from the Council. He preferred an annual appointment of the Local Boards instead of their being made permanent, because if the appointments were found to be good ones they could easily be continued.

The resolution was then carried.

Mr. Hole (referring to the statement of the Chairman, that it was proposed to omit the subject of drawing from the next programme) asked what were the government arrangements for the Examinations in drawing.

Mr. Cole replied that upon an intimation being sent at any time to the Department of Science and Art that 50 candidates were prepared for examination in drawing, an inspector would be sent down for that purpose. On that account it was thought unnecessary to include the subject of drawing in the Society's programme.

Mr. Chester remarked that the Council attached great importance to drawing, and if the operations of the Department of Science and Art, as explained by Mr. Cole, were not found to be satisfactory, the matter would no doubt be taken up again by the Society.

V.—Local Boards and Prize Schemes.

The Chairman read the next question for discussion, viz.:—

Can the Local Boards advantageously act as administrators of "Prize Schemes" for children between 12 and 16 years of age, so as to induce them to continue their instruction between the time at which they leave their elementary school and the time at which they become admissable to the Examinations of the Society of Arts.

Mr. Chester said, in 1854, when the Educational Exhibition was held by the Society, he made a proposition with reference to prize schemes for children, which he thought, now that these Local Boards were established, might be successfully carried out. He suggested that they should not confine their operations merely to the Examinations under the system at present established, but that they should be invited to undertake on behalf of children between 13 and 16 years of age that which they now performed, through the Society, for adults. The children of the poor were for the most part taken from school at a time when it was a mockery to talk about their being educated, and after they left school at that early age, no inducement was held out to them to continue to educate themselves. They wanted some stimulus to children between the ages he had mentioned. It might be asked, why should not children of 13 be admitted to the Society's Examinations? to which he would answer, that it was not considered desirable that the examination of adults and children should be combined. He thought, if the plan he proposed were carried out, it would excite an interest amongst the children, and operate as an inducement to continue their education after leaving the elementary schools. The distribution of small prizes would act as a stimulus, and the Examinations which he suggested would be a means of testing the various systems of education. He suggested that not prizes only, but certificates also, should be granted, and that those children who gained certificates should be made honorary members of the institutions in their localities. It would be the means of directing the attention of the children to those establishments, in which they might still further pursue their education, and at the age of 16 or 17 those who had been honorary members would become subscribing members of the Institutions.

Mr. Blake, having visited a great many Institutions, and witnessed their working, would say that he had found a great want of some such scheme as was now suggested. They now wanted every opportunity to point out the great value of the certificates of the Society of Arts. They wanted something which should, without interfering with what they were at present doing, be in some measure preparatory to it. In some Institutions, this had already been done, viz., holding preliminary examinations on elementary subjects, and the awarding of small prizes to those who excelled. If the Council would recommend that the Local Boards should direct their attention to giving positive encouragement to those Institutions which had these elementary classes, he thought that good would be done, not merely in that direction, but also in the way of preparing candidates for future examination. He would give his testimony as to the value of some such scheme as had been put forth by Mr. Chester.

The Rev. Canon Girdlestone was strongly in favour of the stimulus created by prize schemes, but he would remind the meeting that there were Boards already employed in carrying out that system in various parts of the country, especially in Bristol and in Staffordshire, and he thought the Society would be travelling out of its way if it attempted to interfere. He thought it better that the Society should devote its energies to the business it had already taken in hand; and he feared that, by interfering with that which was going on successfully under a separate supervision, it might suffer in that department to which its attention, he thought, was more judiciously devoted. Agreeing as he did entirely in the system of prize schemes, he deprecated that matter being taken up by the Society of Arts.

Mr. Chester begged to be understood that he did not propose to take the work out of the hands of the existing associations, but where there was no better organisation, his proposal might be adopted.

Mr. Henry Cole said they had been reminded by Canon Girdlestone that the present proposition would interfere with existing prize schemes. There was, however, this one important element in it, that it would be a means of testing the results of education; and if they could employ the Local Boards in bringing the children together, and reducing their education to an absolute test, it would, in his opinion, lay the foundation for the best possible means for encouraging education.

Mr. J. C. Buckmaster (Royal Polytechnic Institution Classes) was of opinion that Mechanics' Institutions were not the places to continue the education of children directly after they had quitted the elementary schools; these Institutions were not able to carry on that systematic education which was desirable in such cases, but he thought many of them might be re-organised so as to effect those objects.

Mr. Andrew Murray expressed his opinion that too often in prize Examinations it was not the most clever boys who carried off the prizes, but those to whom their parents had been most liberal in their education. He had found great difficulty in getting the mentally superior boys to come forward for Examination. In the Institution which he represented (Portsea), they had taken the boys in hand as much as possible by the establishment of classes for their instruction.

Mr. Hole said the difficulty he had experienced was the want of teachers for these young lads. He had established a small institution in Leeds, and the only teachers that could be got were the more steady young men from the neighbouring workshops, but they did not carry with them the respect which ought to subsist between the pupil and the teacher, and hence the progress made was anything but satisfactory. What they wanted was efficient teachers in the evening schools, which, he believed, would do more than anything else to induce the pupils to attend the classes of Mechanics' Institutions.

Mr. Sopwith considered this a most important question. In his own experience he had brought to bear the prize scheme in connection with education with great success, and this had had the effect of stimulating the young persons to continue their education up to the time when they became eligible for admission as members of the Mechanics' Institutions. Mr. Sopwith proceeded to explain the system of prizes he had adopted in the district of Durham as rewards for punctual attendance at

school as well as progress in education. The prize which was most esteemed by the children was that termed an "office ticket," which consisted of a handsomely ornamented card, which formed a certificate of merit in the subjects in which the scholars had distinguished themselves. This prize—though extremely inexpensive—was most eagerly sought by the scholars.

The Hon. and Rev. Samuel Best, though entirely agreeing with the spirit of Mr. Chester's proposition, would nevertheless be sorry to see the Society interfere with the existing prize schemes and local examinations of school children. The Institutions which he represented were anxiously endeavouring to carry out the views represented by Mr. Chester. The moment the children became scholars in evening classes the Examinations were open to them.

Mr. Chester said that Mr. Best was doing in his district that which he wished to see carried out in other places which were not as fortunately provided for.

Mr. Best considered that the Yorkshire Union, like the Association he represented, was in a position to do a great deal in this direction, and could render great assistance in working up to the point of the Society's Examinations. In his Association they had held 75 Examinations during the past year, principally of boys attending evening schools. He looked upon those Institutions as most valuable in rescuing youths at the period of life when there was the greatest difficulty in contending with the evil influences by which they were surrounded.

The Rev. J. H. Ryland considered this was a question which addressed itself to every Institution. He must object to the idea that the influence of the Society of Arts Examinations did not extend to the humblest and youngest members of the Mechanics' Institutions. He believed that from the moment these Examinations had been mentioned, a higher aspiration had been excited in the Institutions. In the Institution at Bradford prizes were given long previous to the starting of the Society's Examinations, and a very little money indeed sufficed for the purpose; the winter evenings were made the occasions of Examinations and distributions of prizes, and he could say that those exhibitions were subjects of greater interest than the soirées of the Institution. Therefore, this proposition quite coincided with the practice that had been pursued in his own locality, and he thought that the Local Boards could very materially aid in this plan.

Mr. Talbot wished to express his approval of the proposition made by Mr. Chester.

Mr. Chester then moved the following resolution:—

That it would greatly promote the interests of public education, and the success of the scheme of Examinations adopted by the Society of Arts, if the Local Boards should act as administrators of 'Prize Schemes' for children between 13 and 16 years of age, so as to induce them to continue their instruction between the time at which they usually leave their elementary school, and the time at which they become admissable to the Examinations of the Society of Arts.

The resolution was seconded by Mr. Andrew Murray.

Sir Thomas Phillips said, having taken part in the administration of prize schemes, he would intimate what appeared to him to be some of the difficulties of the system in adapting it to the objects which Mr. Chester had pointed out. All the prize schemes with which he was acquainted were limited to children at school, and they embraced two objects—first, the promotion of a regular attendance at school, by making punctuality a qualification for examination; and secondly, the inducing a prolonged attendance at school, by requiring that candidates shall have been scholars for a given period, and for a definite number of days in the year preceding the examination. Prize schemes, therefore, as at present constituted, simply dealt with children at school, but it might be desirable so to enlarge their sphere as to admit of the examination of children not at school. At present he did see his way to that object. He could not help thinking that Mechanics' Institutes, out of which Local Boards emanated, had been too exclusively, in many instances, under the control of one particular class of society, and nothing would more tend to give efficiency to those institutions than to introduce into them, to a larger extent, the employers of labour. Prize schemes had been hitherto administered by employers of labour, who had contributed funds to promote the increased intelligence of the people around them. Although he was not quite prepared to affirm the resolution of Mr. Chester, yet he agreed with him in the object, if it could be accomplished, of inducing the Local Boards to aid in the administration of prize schemes. He had at the present time the names of 300 children who were coming up for examination in the Monmouthshire Association. They were operating not inconsiderably in this direction, in that and the neighbouring counties, upon the class of children embraced in the proposition of Mr. Chester. At the same time he should be pleased to see the Local Boards turning their attention to promoting the education of children who were taken from school at 10, 11, and 12 years of age; but with his present experience he did not see his way to the employment of the Local Boards for that purpose.

The Rev. J. H. Ryland wished to know through what opportunity the children would be allowed to compete in these examinations. Must they not belong to some Institution in union with the Society, before they could come up for examination?

Mr. Chester wished the scheme to be left open as wide as possible. Let them take the children wherever they could find them of a given age.

The resolution of Mr. Chester was then put by the Chairman and carried.

VI.—Metropolitan Museums and Local Institutions.

The Chairman then introduced the 6th subject for consideration, viz.:—"Whether the central museums and galleries in the metropolis, which are the property of the public, or subsidised from the public funds, could be rendered useful to the Institutions in different parts of the country, by systematically lending to them specimens for exhibition, or by granting to them unrequired duplicates."

Mr. Henry Cole said the Council had been induced to bring this subject before the Conference, in consequence of the satisfactory results that had attended the circulation of various specimens of art through a number of schools of art in the country. Last year they were aware that a large exhibition was held at Manchester, to which were forwarded a number of specimens from the department over which he had the honour to preside. About one thousand specimens were sent to Manchester, and not a single accident had occurred to one of them. The Department with which he was connected had also sent round to various places in the provinces a collection of the value of £10,000, to which the Queen had contributed some articles. This collection had been sent to twenty-five places, in all parts of the United Kingdom. At the present time it was at Limerick, and not a single accident or injury to any of the specimens had been reported. The collection he referred to had now been three years in circulation, without accident of any kind. The schools of art to which the specimens were sent were simply required to provide room and lighting, and a certain amount of police. An officer accompanied the collection, and in some places it had been the means of bringing a considerable revenue to the Institutes where it was exhibited. In Dublin it had drawn a sum of £200 from the public. It was unnecessary for him to state that there were duplicates and a multitude of things in the British Museum which were not wanted there, but which might form a useful migratory museum, to be circulated through the Mechanics' Institutions in the provinces. In the National Gallery, it was stated that

there were pictures which would not be required for the central collection, and Mr. Ruskin had stated that five or six collections of the late Mr. Turner's pictures might be sent round into the provinces, to exemplify the style of that great artist. He believed that, if the Institutions made a stir in this matter, there was no reason why there should not be circulating museums of the superfluous treasures of the central national collections; and his own opinion was, that if the various Institutions put a pressure upon their representatives in Parliament, the Government would be inclined to yield to the request that the provinces should have that boon conferred upon them. In France, there was hardly a provincial town in which there were not local collections or museums, which were interesting enough, but not, in his opinion, so interesting as a succession of such collections would be. On the part of the Council, therefore, he begged to press this matter upon the attention of the delegates.

Mr. McIvor had great pleasure in supporting this suggestion.

Mr. Blake believed the people in Yorkshire cared very little about seeing the whole contents of the British Museum. He did not anticipate any great advantages from the proposition.

Rev. J. H. Ryland wished to vindicate the people of Yorkshire from the character of indifference in such matters which had been ascribed to them by the last speaker. He thought a migratory museum would be very highly appreciated by the people of the provinces.

Mr. Pearsall contended for the London Institutions being included in the proposition.

The Rev. A. W. Worthington considered it would be a great boon to the country towns to have such a collection sent round.

The Rev. Canon Girdlestone proposed—

That it is desirable that the Central Museums and Galleries in the Metropolis, such as the British Museum, the National Gallery, &c., which are the property of the whole nation, should be rendered, as far as possible, useful to the Institutions in different parts of the country, by systematically lending to them specimens for exhibition, or by granting to them unrequired duplicates.

The Rev. J. H. Ryland had great pleasure in seconding the motion.

Mr. Pearsall proposed, as an amendment, the insertion of the words "including London," which was seconded by Mr. W. D. Boulter (Crosby Hall Evening Classes.)

Upon a show of hands the amendment was negatived by a large majority, and the original motion was carried.

VII.—Opening of Museums in the Evening.

The next proposition considered was, "Whether the conference should pass any resolutions in favour of the opening of the national museums and galleries to the public of an evening."

Mr. Chester had no hesitation is calling upon the conference to answer that question in the affirmative, and the resolution he would propose was—

That this Conference requests the Council of the Society of Arts to bring under the consideration of Her Majesty's Government the question whether the National Museums and Galleries cannot and ought not to be opened of an evening, in order that they may be accessible to those numerous classes of the community who, contributing towards the expenses of maintaining the National Museums and Galleries, and being well able to profit by access to them, are at present practically debarred from visiting them, because they are only open during the day.

He said that large masses of the community were virtually excluded from the great national exhibitions, from the circumstance of their being closed in the evenings. The experiment of evening exhibition had been tried at the South Kensington Museum, which had been visited by between 3,000 and 4,000 persons a week in the evenings. They were mainly indebted to the exertions of Mr. Henry Cole for that great public boon.

Mr. Robert Rumney seconded the resolution.

Mr. Henry Cole said it might not be generally known that 800,000 upon an average annually visited the metropolis from the provinces, most of whom were probably engaged in business in the daytime. He laid before the meeting statistics which he had collected, showing that in several large manufactories within easy distances of the National Gallery, out of the hundreds of the workmen employed in these establishments very few had ever visited that exhibition, and the same with the British Museum, owing, in a great measure, to the fact that those places were closed in the evenings, which was the only opportunity that the generality of the working classes had of visiting them. During the last year the South Kensington Museum had been visited by no fewer than 488,000 persons, of whom by far the greater number had attended in the evening, the museum being open for three hours on three evenings in a week. He thought the delegates of the various Institutions would render good service by passing this resolution, and suggested that they should urge the matter upon the attention of their respective representatives in parliament.

After a brief conversation the resolution was unanimously agreed to.

VIII. List of Lecturers.

The remaining subject upon the paper was "Whether the Society's list of lecturers shall be republished."

Mr. W. R. Kennard (Falkirk School of Arts) proposed the following resolution:—

That with reference to the republication of the list of lecturers, this Conference desires to express its opinion of the importance of encouraging the system of public lectures, and it urges upon the officers of the Society of Arts to give their best assistance to the Institutions in connexion with the Society, to assist them in obtaining the services of the most talented and experienced lecturers.

The delegates who took part in the discussion that followed upon this subject, expressed generally an opinion in favour of the republication of the list of lecturers. It was stated on the part of the Council that the list was prepared from the returns of the Institutions with respect to the lecturers they had employed, but that the Council could not undertake to recommend any particular lecturers, or to make arrangements for their engagement by the Institutions.

After some conversation the resolution of Mr. Kennard was withdrawn, and the following resolution, on the motion of Mr. Edwards (Tailors' Labour Agency), was passed:—

That this Conference requests the Council to republish the list of lecturers.

The business upon the paper having been concluded,

Mr. Spencer (Greenwich) moved a resolution to the effect that a separate account should be kept of the funds received from the Institutions in Union and the disbursement of the same, in order, he said, that they might judge of the amount of benefit which they derived from their connection with the Society. In his own Institution it had been questioned whether the advantages they derived were equal to the subscription they paid.

The Chairman said the account had been kept separate from the first, and had been so published in the *Journal*, as a part of the annual financial statement of the Society, a copy of which had, as Mr. Edwards was aware, been sent to every Institution. In addition to this, the Society's books were open to the inspection of every member. Upon the subject of the benefit derived by the Institutions from the union, he would inform them that the Society had this year received £540 from the Institutions and had spent upon them £1,070.

After a brief conversation the resolution, which found no seconder, was withdrawn.

Mr. H. W. Freeland (Chichester Literary Society), with reference to the question of rating, stated that after

the expression contained in the report, the opinion of the meeting would probably be that it was not desirable to discuss it on the present occasion, but he was prepared with a resolution, if the meeting thought proper to entertain it. He would not however press it.

The Chairman remarked that the feeling of the present legislature was evidently opposed to exemptions of any kind, and he would suggest that the subject should remain in abeyance.

The matter then dropped.

Mr. Blake introduced the subject of the subscriptions of the institutions, and expressed an opinion that the sum of 2 guineas debarred a great many small Institutions from participating in the advantages of the Union.

The Chairman said the propriety of adopting a scale of subscription in proportion to the number of members, was a matter that would be recommended by the present Council to the consideration of their successors.

Mr. R. Craske (Bury St. Edmunds Athenæum) brought forward the subject of the distribution of the prize fund for 1857, which had been made a ground of complaint by him in a pamphlet circulated amongst the Institutions.

Mr. Chester, in reference to this matter, said he considered there had been a want of fairness on the part of Mr. Craske in not publishing the whole of the correspondence which had taken place on the subject, although requested to do so by the Council, he having withheld the letters which passed between the Council and his legal advisers, who had written threatening proceedings against the Council.

Mr. Craske said that a portion of the pamphlets were printed when the communication of the Council was received.

The Chairman explained that a considerable amount of the subscriptions to the fund of last year was for special purposes apart from the Examination Prize Fund, in addition to which he might state that several amounts that had been promised had not been paid. Any balance that remained from the fund of last year was carried to the account of the present year.

The subject then dropped.

Mr. Barnett Blake proposed the thanks of the Conference to the chairman for the able and courteous manner in which he had presided over the business of the day, and for the exemplary patience he had displayed throughout the proceedings, which had been of an unusually protracted character.

The motion was carried by acclamation, and the chairman having acknowledged the compliment, the proceedings terminated.

ONE HUNDRED AND FOURTH ANNIVERSARY DINNER.

The one hundred and fourth anniversary dinner of the Society, took place at St. James's Hall, Piccadilly, on Thursday, the 24th inst. About 250 gentlemen were present on the occasion. The Chair was occupied by the Right Hon. the Earl of Carlisle, K.G., who was supported by the Master of the Mint, Vice-President, Mr. Henry Thomas Hope, Sir Joseph Paxton, M.P., Vice-President, Mr. J. Scott Russell, F.R.S., Vice-President, Mr. W. H. Bodkin, Sir George Smart, Lieut. Colonel H. C. Owen, R.E., C.B., Mr. Thomas Sopwith, F.R.S., Mr. C. Wentworth Dilke, (Vice-President and Chairman of the Council,) Mr. Harry Chester, Vice-President, Mr. Thomas Winkworth, Vice-President, Mr. J. G. Appold, F.R.S., Sir Thomas Phillips, Mr. Matthew Marshall, Mr. Joseph Glynn, F.R.S., Vice-President, Dr. Chambers, Mr. Peter Graham, Mr. Matthew Uzielli, Mr. J. Griffith Frith, Mr. W. Fladgate, &c., &c.

At the table appropriated to those interested in the Fine Arts and Architecture, were Mr. Dyce, R.A., Mr. J. H. Foley, R.A. Mr. G. T. Doo, R.A., Mr. Lewis Haghe, Mr. George Scharf, junr., Mr. Owen Jones, Mr. G. G. Adams, Mr. F. S. Cary, Mr. M. Hanhart, Mr. J. Leighton, F.S.A., Mr. Claudet, F.R.S., Mr. T. A. Tefft, (United States), Mr. G. Clowes, Mr. E. Clowes, Mr. A. Edgar, Mr. J. C. Deane, Mr. George Godwin, F.R.S., Mr. H. G. Bohn, Mr. J. Bell Sedgwick, Mr. F. Joubert, Mr. Henry Pollock, Mr. Henry Mogford, &c., with Mr. John Dillon as Chairman.

At the table appropriated to the Committees of the Society, were, among others, Mr. W. Coulson, Mr. Holmes Coote, Mr. Joseph Toynbee, F.R.S., Dr. Chowne, Mr. William Adams, Mr. Brodhurst, Mr. Vasey, Mr. R. W. Tamplin, Mr. Frank Buckland, Mr. T. B. Curling, Mr. George Critchett, Mr. J. R. Traer, Mr. James Glaisher, F.R.S., &c., with Mr. James Luke, F.R.S., as Chairman.

At the table appropriated to the Institutions in Union, were among others, Rev. Harvey Godwin, Rev. J. Morgan Cowie, Professor Williamson, Professor Mariette, Rev. Charles Mackenzie, Mr. Alexander McIvor, Mr. Ivan C. Jenkyns, Rev. J. H. Ryland, Mr. Andrew Murray, Mr. Rumney, Mr. Honey, Mr. W. D. Boulter, Mr. William Hughes, &c., with the Rev. Canon Girdlestone as Chairman.

At the table appropriated to Engineering, Commerce, and Manufactures, were among others Mr. R. L. Chance, Professor Leone Levi, Col. Hamilton, Major Schoones, Colonel Andrews, Mr. Benjamin Fothergill, Mr. T. R. Crampton, Mr. John Braithwaite, Mr. C. W. Siemens, Mr. W. Hamilton, R.N., Mr. Alexander Redgrave, Mr. G. Myers, Mr. A. Salomons, Mr. J. R. Lavanchy, Mr. Henry Sich, Mr. Stephen Lewis, Mr. W. Atkinson, Mr. W. Westly, Mr. Joseph Fenn, Mr. T. N. R. Morson, Mr. Hyde Clarke, Mr. P. L. Simmonds, Mr. T. Aston, &c., &c.

Grace having been said by the Rev. Charles Mackenzie,

The Chairman rose and said—Gentlemen,—I give you "The health of Her Majesty, the Queen." I sincerely trust, as, indeed, I heartily believe, that her Majesty commands the devoted loyalty of every class of her subjects; but I am also convinced that her qualifications and virtues are appreciated in proportion as those subjects are intelligent, educated, and refined. "Her Majesty, the Queen."

The toast was drunk with the customary honours.

The Chairman.—The next toast comprises—"His Royal Highness the Prince Consort—President of the Society—the Prince of Wales, and the rest of the Royal Family," and with reference to the Royal personage who is specially connected with this Society—the Prince Consort—I will merely observe that the services of His

Royal Highness to the Arts, the Sciences, and the Manufacturing Industry of the country, so far from being merely superficial and clap-trap, will be found to be solid, truthful, and enduring. I beg to give—"His Royal Highness the Prince Consort, the Prince of Wales, and the rest of the Royal Family."

The toast was drunk with loud cheering.

The CHAIRMAN again rose and said—Gentlemen,—In now having to call your attention to the toast which more immediately concerns the purpose which has assembled us here together, I really feel that some excuse to you is due in consequence of that toast being entrusted to a person who, for peculiar reasons, and his previous absence from this country, probably knows less what to say about it than almost any one of those whom he has the honour to address. When I allude, however, gentlemen, to my absence from the country and from the sphere of the operations of this Society, and from this metropolitan centre of art, I do not mean to convey that I have been exiled, like the poet Ovid, to a barbarous country—on the contrary, gentlemen, one of the last duties I had the honour of performing in the sister country was the inauguration of the statue of the great lyrical poet, Moore, in Dublin. I trust, also, that I have bequeathed a project of erecting another statue in the same city—one to Oliver Goldsmith. (Protracted cheering.) Now, gentlemen, will you do as much for the statues of our poets in London? (Renewed applause.) I am very happy, too, in the presence of our friend Mr. Deane, to bear my testimony to the beautiful architecture with which his father and his brother have adorned the metropolis of Ireland. However, gentlemen, for the reasons I have mentioned, I feel myself less able than almost any one of you to give you any succinct account of the recent operations of this Society. I do not feel called upon so delve into its remote antiquity—time-honoured as its annals have proved themselves to be. It will be sufficient for me to advert to the impetus which your Society has lately given to that which is justly considered as one of the leading movements of the day, the system of public examinations. I know that a great object with your Society has been to promote the formation of classes for instruction, not as a substitute, but as a useful and even a superior supplement to the desultory delivering of lectures; and I believe this promising system is very mainly owing to the zeal and energy which were displayed upon the subject by one of the members of your Council, Mr. Chester. (Hear, hear.) As an inducement to the formation of these classes for instruction, the Society of Arts has instituted a system of examinations, and give certificates for three different grades of merit. Now, what has been, briefly, the progress of this experiment? I find that when the offer was first mooted, it was responded to by only one candidate. In the next year, 1856, the first examinations were held in London, upon which occasion 52 candidates attended. It was found that the various Mechanics' Institutes throughout the country which had been affiliated with this Society found it inconvenient to send their respective members up to one single centre of examination in London; and, in the next year, 1857, two central places of examination were adopted, London and Huddersfield, the latter happening to be the head-quarters for that year of the Yorkshire Union of Mechanics' Institutes. 80 candidates attended that year in London, and 140 in Huddersfield. As, however, these two centres of examination were found very inconvenient for those who wished to attend the examinations,—members of the 320 Institutions associated with this Society, and scattered through the length and breadth of the United Kingdom,—it was thought advisable to adopt a scheme which would very much dispense with that inconvenience, and it was determined to hold the examinations simultaneously in various places through the whole extent of the union wherever the local bodies were provided with the necessary organisation; and it was settled that the examinations were to be conducted wholly by papers. Fifty-eight Local Boards were established, at forty of which candidates have in the present year presented themselves. The list of prizes and certificates has been published, and it occupies a goodly space in the publications of this Society, and as a living instance is worth a good deal of paper, I am happy to say that we have at this board a gentleman partaking of our fare (Mr. Wicker), who, in the modest position of an apprentice in the Dockyard at Portsmouth has carried off three prizes at the recent contest. The labours of the Society have by no means been confined to the subject of examinations. Among the important subjects which have attracted its notice since the last anniversary I may enumerate the consideration of the law of Artistic Copyright, in reference to which, I believe, there is a scheme in a great degree of forwardness, and which I hope may be submitted to the legislature. It has also had under its consideration the means of securing the durability of gutta percha, and the cheap production of aluminium. Now, with reference to the more general subject of art, which it is the special province and object of your society to foster and promote, I think there is no doubt that, with some drawbacks and exceptions, it is impossible not to feel that a great general advancement has been made in the public taste and refinement. I think indications of this are to be perceived in the exterior of our dwellings, in the decorations of our apartments, in the forms and fashion of our furniture, in our plate, in our porcelain, in the increased taste for painting and for sculpture—and I may, I am sure, allude to that gay concave and that starry firmament now above us. Of course all exteriors and all interiors will not be so happy and so admirable in their execution as either the Museum at Trinity College, Dublin, or the St. James's Hall, of London. True art, like every other good thing, must always to a certain degree be accompanied by its conceits and its quackeries; but allow me to say that the very existence if the imitation proves in some degree the presence of the reality; and I feel sure, that never, as a country, were we less liable to the accusation of being indifferent to the high claims of art and of literature. This, gentlemen, happily is not the place for the introduction of any topic even bordering upon politics, for it seems to be a certain law in politics that there is always something bitter or disparaging to be said about either things or persons. I may still, however, be permitted to remark that two of the highest and most important offices in the present administration of the country are filled by gentlemen most distinguished in literature. I turn to the most eloquent orator in the House of Commons, and I find Mr. Gladstone devoting his leisure not merely to elucidate the consummate merits of the prince of poets, but to trace and illustrate the connexion between the veritable traditions of antiquity and that scroll of heavenly revelation which is the charter of hope and the blessing of the whole family of men. What then, next, is all but the latest addition to the ancient peerage of this realm? Why the most eminent of historians—Lord Macaulay. Now it seems to me that these particular cases go far to show that literature, at least, has in our days obtained its due recognition and honours in the state. It is the more special object of your society to encourage and increase a relish and reverence for art among the masses of our countrymen; and I trust that under the joint ennobling influences of literature and art, our glorious old England, which has so many other titles to greatness, is destined to fulfil all the highest missions of civilisation. I beg to give "Prosperity to the Society for the Encouragement of Arts, Manufactures, and Commerce."

The toast was drunk with protracted cheering.

Mr. C. WENTWORTH DILKE (Chairman of the Council) said it would ill become him to detain them more than a few seconds in acknowledging, on the part of the Society, the graceful manner in which their eloquent chairman

had introduced this toast. For his own part he might state that his star of office in the Society was fast waning, but he could not but say that he had never been associated with a body of gentlemen who were more anxious than his colleagues in the Council to promote in every possible way the advancement of Arts, Manufactures, and Commerce. He ventured to assert that although some errors might have been made, they were errors of judgment, and not errors of intention.

Sir Thomas Phillips said he had been entrusted with the toast of "Prosperity to the Institutions in Union with this Society." Unless he had deceived himself very much, the Institutions in Union were calculated in time to produce a very important effect upon the education of the artizans of this country. The object, as he understood it, of this Society in associating with itself the various Institutions connected with the instruction of the working classes, was to systematise the advantages offered to them in these various Institutions, and to afford to the individuals in them the opportunity of systematic examination, and, where they deserved it, of appropriate reward. But very few years had passed since this scheme of the Society was promulgated, and, considering the necessary difficulties that presented themselves to the carrying out in the length and breadth of the land an organisation so important as that which they had sought to establish, the success that had attended it was no unsatisfactory omen of its future importance. The noble earl in the chair had told them that two years ago one single candidate only presented himself for examination. This year, however, more than 500 young men were reported to the Society as being qualified to be examined in one or other of the subjects included in the Society's programme. Three hundred, or nearly that number, came up for examination, and, he believed, but for accidental circumstances, connected partly with the period selected for the examination, and other matters which did not affect the merits of the candidates, 400 persons would have been examined. Of those 300 who came up, 199 were certified to be deserving of the Society's certificate, and those 199 successful competitors took away 360 certificates. Now, he could not help thinking that although that was an inconsiderable number compared with the number of young men who were seeking to prepare themselves for the active duties of life by self-culture throughout this country, it was nevertheless no unsatisfactory indication of the extent to which this movement might at no distant period be carried. When they looked around them, and beheld in their own times and in the generations now past, the distinguished men that had risen from inferior positions of life—acquiring well-merited distinction by their own unaided powers, and the faculties which God had given them, he was sure they would not regard any estimate too high which might be formed of an Institution which laboured to give stimulus and encouragement to their praiseworthy efforts. What would George Stephenson have given for the educational advantages enjoyed by young men in the present day? What would men who had risen like George Stephenson—(and he believed there were not on record circumstances more interesting than those which surrounded the life of George Stephenson)—what would men like him have given if they could have obtained that amount of assistance which the aid this Society offered gave, and if they had known that at the age of 16 years those advantages were open to them. They lived in times when the economical pressure of the age limited rather than extended the period of school life. It was most deeply to be deplored. Those who thought most upon the subject doubted most whether the period could be extended. They could hardly hope to extend it while the pressure of necessity compelled parents to send their children out into the world to assist in supplying the general wants of the family. Therefore it was of the deepest importance that—having sown the seed in early life—in the school life, they should afford, as far as in them lay, the opportunity of continuing that training and that culture during the period of active labour. That could only be done by means such as this Society afforded, or rather the means afforded by the local Institutions; and here it was that their assistance and suggestions seemed to be of the utmost importance to these local bodies. He himself had the honour to belong to a local Institution in a part of the country where he was sorry to say that adult instruction was pursued to a very inconsiderable extent, but no one could doubt, from the activity that prevailed throughout the country—from the circumstances connected with these Examinations—from the character of the persons who had succeeded—from the position in life of many men who had obtained first prizes—that they were sowing seed which would at no distant time produce to them a rich harvest. He would not detain them longer. The noble chairman had directed their attention to the fact that they had in the room a young man of well-merited distinction, and he hoped such an example would act as a stimulus to others in the same walks of life to seek to earn the distinction he had gained. He begged to propose "Prosperity to the Institutions in Union with the Society of Arts."

The toast was drunk with cheering.

The Rev. Canon Girdlestone said it was with sincere satisfaction he rose to tender the thanks of the provincial Institutions in connexion with the Society of Arts for the honour done them by the present toast. It had been observed during the course of the morning's proceedings, and, he believed, in some degree questioned, —what benefits the Institutions derived from their connexion with the Society of Arts. For his own part he spoke his own feeling, and, he believed, the feeling of the great majority, if not of all, the representatives of the institutions, when he said that it was impossible to calculate the advantages which they in the provinces derived from the connexion with this central Society. He thought they had only to look to that topic which had been already adverted to, viz., the system of examinations which had been instituted in connexion with this Society, to see at once the great advantage which they derived from their union with it. He had also to express the deep gratitude he felt for what the Committee of Council on Education had done in this great cause; but if there was in this country one class more than another for whom little had been done in the way of education it was the middle class. He, therefore, hailed with the greatest satisfaction this movement which had emanated from the Society of Arts, and he believed if it was carried through with the zeal with which it had been commenced, it would do an incalculable amount of good in stimulating competitive examinations in the Grammar Schools and other establishments in which the middle classes for the most part received their education, and in this respect he regarded the connection of the provincial associations with this Society as a great advantage; even in the mere matter of money—although, of course, guineas were but a poor measure of the value of this privilege—yet in the mere matter of money alone, the Society had done quite as much for the provincial institutions as the institutions themselves had done for the Society of Arts, and, indeed, much more. But passing from that which was gone by to that which was still to come, he did hope that if those resolutions which had been passed in the morning were carried into effect, if they were permitted to meet again at the close of another year, they would have to perform a still greater act of gratitude to this Society. He would take this opportunity of impressing upon the gentlemen who formed the Council of the Society, that no greater boon could be conferred upon the middle classes of the provinces than enforcing upon her Majesty's Government the great desirability of first of all opening the various public museums of the metropolis in the evening to the middle and the labouring classes, and, secondly, that some portions of

what might be called the superfluous wealth of those museums should, in some sort of manner, be made to minister to the advantage and instruction of the provinces. He confessed that as a minister of that word which the noble lord in the chair had so eloquently described as the great charter of the whole family of man, he hailed with the greatest gratitude, as the handmaid of religion, the progress of science, art, and education. In no case was religion more thoroughly brought to bear than in those operations which were under the influence of the Society of Arts. Therefore, he had no hesitation, as a minister of the Gospel, in tendering, as the representative of an Institution in one of the most ancient cities of the country —Bristol—his gratitude to the Society for permitting the union which existed between them, and in thanking the company most sincerely in the name of those representatives of Institutions by whom he was surrounded for the honour they had done them in drinking this toast.

Mr. Harry Chester said:—Any stranger attending the Conference which took place that morning, would probably have gone away with the impression that the only matters upon which the Society concerned itself were those connected with the education of the people; and although he would have seen that the largest interpretation was given to that term, that they considered it to include not only the instruction of the people, but likewise all that concerned their social and industrial position; he might have been tempted to ask why it was that the Society for the Encouragement of Arts, Manufactures, and Commerce concerned itself so anxiously with the education of the working classes. The answer to that was that they knew there was no means by which they could carry out the chartered objects of the Society so well as by laying deep and extending the foundation on which all improvements in arts, manufactures, and commerce must depend. But they did not confine themselves to education, they dealt with every kind of subject which could be reared on the superstructure of that foundation. He had been requested to propose that they should drink to the health, and wish success to the labours, of those gentlemen—a very numerous body—who formed the various committees of the Society of Arts. He thought his powers of arithmetic would fail if he attempted to tell how many members were serving upon their committees; but he wished them to bear in mind that as the Society of Arts was a multifarious and omnivorous body, which concerned itself with all kinds of subjects, it would be impossible for any body, limited as the Council must be, to discharge one-tenth of its functions, or to touch one-tenth of the subjects embraced by it, unless they were assisted by some extraneous organisation co-operating with them. Those committees (said Mr. Chester) are, in fact members of our body. They are our means of locomotion, our wings and feet, which enable us to pervade all sorts of subjects. They are our tentacula, which enable us to feel our way, to feel where we can safely go, and where we had better withdraw. They are the prehensile instruments, which enable us to lay our hands on things and persons. They are our stomach, in which all sorts of things are digested and brought into proper condition to be dealt with by the Council. Some of the subjects with which the Society is dealing have been already alluded to. Your lordship has mentioned the Artistic Copyright Committee, presided over by Sir Charles Eastlake. I may further mention that we have a committeee which has prepared a report about to be circulated to the Institutions and Chambers of Commerce in Union, on the subject of a Small Parcels Post. The Society desires to have it well considered whether the facilities afforded by the Post Office for the transmission of letters might not be extended to the transmission of small parcels. There is another committee which is engaged on a smaller and more humble, but yet useful subject, the invention of a good portable writing-case for soldiers, sailors, and emigrants. There is another committee dealing with the very important subject of Gutta Percha, investigating the causes of its decay, and pointing out the nature of the defects to which that substance is incident, and the remedies to be obtained for them. Another committee is engaged in considering whether in the suburbs of this metropolis and in the provincial towns, galleries, and museums in connection with the great central National Gallery and Museums of the metropolis might not with advantage be formed. Another committee is employed in dealing with the subject of Aluminium, and another with the subject of Surgical Instruments, and this last is the committee to which I would direct your particular attention, because I have been instructed to couple with this toast the name of the gentleman who acts as the chairman of that committee, Mr. James Luke. I believe those most conversant with surgical instruments, are of opinion that they are not in that advanced state of perfection in which they ought to be; that sufficient prominence was not given to that department in the Exhibition of 1851, and that the time has arrived when special attention should be directed to that subject. A large committee is, therefore, engaged in considering their present state, and how they may be improved. That subject has been considered worthy the attention of the most distinguished members of the medical profession, and those gentlemen have done Mr. Luke the high honour to request him to preside over them. That is an honour which he may justly be proud of, for it is no small distinction for a gentleman to be selected by a large body of his own profession to represent them in this most important matter. I am sure, therefore, you will with great pleasure drink "The Health of the Committees of the Society, coupled with the name of Mr. James Luke, the Chairman of the Committee on Surgical Instruments." (Much applause.)

Mr. James Luke said he felt that in attempting to return thanks he had undertaken an extremely difficulty task, because there were so many different sections composing the various committees, and he could only very imperfectly represent that with which he was more immediately connected. He felt that it was unnecessary to enlarge upon this toast, because so much had been said already upon the general characteristics of this Society, that even if he felt inclined to lengthen his remarks, they would be but a repetition of those which had been offered by preceding speakers. He could only say that the various members of the committees were most anxious to carry out the tasks entrusted to them by the Council of the Society, and, having said this, he could only add the expression of their sincere thanks for the honour now conferred upon them. (Cheers.)

Mr. J. Scott Russell, F.R.S., then rose and said:— My Lord and Gentlemen,—I have great pleasure in proposing the toast which has been placed in my hands this evening, and I am sure you will have great satisfaction in hearing that the speeches appropriate to the toast have already been made by my predecessors, so that it is not now necessary for me to make any long preface to it. The toast which I have to propose is "The Society's Examiners" in those educational examinations of which you have heard so much to-night. The noble lord in the chair has informed you that one of the most important functions which the Society now performs is that of encouraging, through its associated Institutions, education in the provinces. In short, from the experience I have had of now nearly 20 years in the working of this Society, I may say that whereas hitherto the Society has chiefly devoted its attention to the arts and inventions which the talent of the working classes of England has produced during the past century of its existence, it has now turned from the cultivation of the inventions themselves to tilling and manuring the soil out of which these inventions grow. It is a modern revelation of chemistry that you can take nothing out of the land but what you put into it. It is a modern revelation of physiology that you cannot take a quantity of

work out of a man unless you put a corresponding quantity of nutritious food into him; and it is also a very recent discovery, due, I believe, to those wonderfully multifarious committees of the Society—that you cannot take inventions out of a man's head unless you put education into it. Now, the experience of the past century of inventions produced before the Society of Arts, and rewarded by them, and the experience and my own knowledge for the last 20 years of the working of the Society, enables me to say this—that that Society has rewarded an enormous number of good inventions, but that it has discouraged at least ten times that number of bad inventions; and that in almost every case the good inventions have been produced where science was superadded to practical knowledge, and that the bad inventions have been produced, and the time of the producers and of the Society wasted, when the inventions were made by practical men who were ignorant of the theoretical principles of those inventions, or by theoretical men totally unacquainted with the practical portion of the subject to which they directed their attention. Now, it is hopeless on the part of the Society to attempt to knock practical knowledge into the heads of scientific men. That is quite beyond their sphere, and I believe beyond the sphere of anybody else, so they have taken to the other duty—that of endeavouring to engraft upon the strong, robust stem of the workman, of the practical man, the graft of education, of knowledge, of the addition, in short, to the experience of the hard-working practical man of that which is called science, but which is merely the experience of all other men added together superinduced upon his. Now, then, I think you will say that in doing this the Society of Arts has come to a very practical conclusion, and a very scientific way of producing practical inventions by the true combination of science with practice. And allow me to say, as having had the good fortune to receive the education of a thorough working man in my youth, and to have had superadded to that the blessing of a university education, permit me to say, after having superintended more or less for the last 30 years the labours of multitudes of men, that I do not know any way in which you could forward the interests of Great Britain more properly at the present moment than by assisting in the education of the working mechanics and practical men of England; because, let me tell you, there is no man so good a workman—there is no man who gives you so large a day's work in return for your day's wages, as your practical workman, who knows the principles of what he is about. Let me tell you, also, that the practical workmen of England are in a little more danger at the present moment than they think for, and the reason is that education in other countries has been—I do not say is—has been making more rapid progress in the last 12 or 15 years than it has been making in England; and allow me to tell you that the German workman in every skilled craft has been making during that time enormous progress, and I may add enormous inroads upon the English workman. Permit me to tell you that there are in this country 86,000 German workmen in the most skilled departments of trade, for no other reason than that they can learn in certain schools of art and working schools in Germany a great deal more of mathematics, of chemistry, and of theoretical mechanics than our own workmen possess, and when we try to get a skilled foreman on reasonable terms, we are generally obliged to take a foreigner,—usually a German. I say this is a great pity, because there is not in the world a finer workman—a man prouder of his work—a man abler to do work in the most finished, solid, substantial, permanent manner, than the English workman, and he only wants that you should do him justice. I say *you*; I will tell you why I say you—that you, the educated, and governing, and leading classes, should do him justice,—to be all that you could desire. I say this, because it is the upper and governing classes in Germany and elsewhere that are providing this education for their workmen. It is not the workmen themselves; therefore, if you want our workmen to keep pace with them, you, the educated; you, the enlightened; you, the metropolitan employers—you must try to do all in your power to extend education among the working men of England. Now, I am happy to say, that the Society's Examiners are a set of educated men, scholars, gentlemen of high reputation, who are devoting themselves to co-operate with you in the most admirable manner, in stimulating, encouraging, singling out, and rewarding all those young men who, under the tuition of the local societies in connection with the Society of Arts, are now very numerous and very successful. Mr. Chester has told us—than whom no one is more competent to form a correct opinion, and who, I believe, had the principal share in pushing on this educational movement—he has told us that the examinations of the present year have been most successful, and, therefore, I propose that we return to the Examiners, on behalf of the working classes, whose interests they have so much promoted, our best thanks for the services they have rendered to the community and to us in the course of the examinations of the present year, and, coupled with that toast, I beg to give the name of a gentleman who is intimately connected with the education of England, and a thoroughly practical man in these matters, the Rev. Morgan Cowie. (Loud applause.)

The Rev. Morgan Cowie returned thanks. He said many of the examiners had been, and still were, connected with education in different places, and they took great interest in this movement which had been taken by the Society, and felt happy in being able to give their time and such talents as they possessed to forward so excellent a scheme. He felt that they were acting as loyal subjects to the Queen in promoting, as far as they could, any plan which elevated the working classes of the country, or which had a tendency to do so. The results of the examinations, he might say generally, were extremely satisfactory, and the number of candidates had considerably increased. He was not one of the examiners till the present year; therefore, he was not competent to make any comparison with former years. In geometry he had very fair results indeed, and also in algebra, which was not a very attractive study to young men of this class. He believed there was still room for improvement, and he hoped in future years to see the system grow. He would not detain them longer than to express, on behalf of his brother examiners and on his own part, their thanks for being permitted to assist in this important work. (Cheers.)

The Chairman gave as the next toast "The House of Commons." It was only right (his lordship said) that they should show their respect for those who represented them in parliament, and he begged to couple with the toast the name of Sir Joseph Paxton, with respect to whom he would merely observe that all the world had had the means of becoming acquainted with his general claims to respect and admiration, but he (the chairman) had had special opportunities of estimating the sterling qualities of his heart and virtues of his life. He begged to give "The House of Commons and Sir Joseph Paxton." (Drunk with loud cheering.)

Sir Joseph Paxton said he could have wished that the duty of returning thanks for this toast had devolved upon some more distinguished member of the House of Commons than himself; but although he was only a humble member of that house, he believed he could duly appreciate the advantages which this country, and he might say the world, derived from having a deliberative assembly so free and so practical as the British House of Commons. It was true that latterly their course had been somewhat eccentric, but he had no doubt that in time the machinery would bring itself right, and they would go on in the ordinary course of legislation. With regard to commerce, he might say that during the last 15 years the House of Commons had been treading in the right direction by liberating it as far as possible from

every trammel. With reference to manufactures, he was sorry that the government had anything to do with them, for the only things they manufactured were arms, cannons, and ammunition, and those were not matters very intimately connected with the progress of the Society of Arts. But with regard to art and invention, he felt that the House of Commons had behaved in a manner suitable to the importance of the subject, with, he might say, one or two exceptions. There was one exception with regard to the Patent Laws. He maintained that it was wrong—that it was unjust, that a man's brains should be taxed—that the inventions of his mind should be placed under the ordinary taxation of the country, and the produce of that tax applied to the ordinary purposes of the State. He contended that if any tax of that kind existed, it ought to be applied for the purpose of advancing the interests of arts, science, manufactures, and commerce; and he thought it was a disgrace to the present age that this revenue should be employed for the ordinary purposes of the country. The House of Commons had always very readily voted money for the maintenance of the British Museum and other establishments for the promotion of art in this country. There was only one thing that they had set their minds against, and that they had done most pertinaciously,—that was against any grand centralization at Kensington. He did not now discuss whether in that they were right or wrong, but he was happy to say that the connection between the Royal Commissioners of the Exhibition of 1851 and the Government was about to close. He believed in a very short time the government would have their money, and the Commissioners of 1851 would be free to act upon their own resources; he hoped they would then see something worth having after the great delay which had taken place. He hoped the Royal Commissioners of 1851, having slumbered for six years, would eventually rise up triumphant for some great good. About 10 years ago they would remember that Europe was the scene of anarchy and bloodshed. Almost every continental city, with but one or two exceptions, was the scene of political disorder and riot. About that time, or a little after, the notion which first emanated from the Society of Arts, for the Exhibition of 1851, was brought forward. Whilst, in 1848, the continent was in the midst of bloodshed and confusion, in 1858 there was nothing talked about but war with our neighbours. He hoped to see some sort of parallel between the two epochs, and that out of war's alarms some other object should arise upon which to centre their ideas and their exertions. On that account he confessed that he felt a little surprised, that neither by the noble lord in the chair, nor by his friend Mr. Chester, nor by any other gentleman connected with the Council of the Society, had a single word been said upon a point which was brought before the public a little while ago, and which was much talked about at the time, viz., an Exhibition in 1861. It did appear strange to him, that after the Council had deliberated and decided upon this point—and he must tell them that, as a vice-president of the Society, he had attended nearly all those meetings—that having deliberately decided that it would be advisable to have an Exhibition in 1861, to which he gave his most hearty concurrence,—he said it did appear strange that not a word had been said upon the subject that evening. By some it was argued that it was too soon after the Great Exhibition, and he believed the proposition fell upon the ears of many persons rather flatly. But he thought if it had been fairly set forth to the public—if circulars had been sent round to the various institutions in connection with the mother Society, they would have heard a little more about the project for '61 than they had heard that night from the governing body of the Society. He had no wish to divulge the secrets of the Council, but he should like to tell the present company what sort of an exhibition the Council proposed to have in 1861. Such an exhibition as that of '51 of course was not contemplated. Another such exhibition, probably, would not occur within 100 years, but an exhibition of a character different from that of 1851,—such as would seem to mark the progress of the time, and give manufacturers and those connected with art and science an opportunity of collecting their productions. For such a purpose he submitted that an interval of ten years was sufficient to elapse between such exhibitions. They were aware that the French, who began with exhibitions 30 years ago, had repeated them every 5 years, and certainly if the people of France saw it was to their interest to hold quinquennial exhibitions, it must be to the interest of this, the greatest manufacturing country in the world, to have similar exhibitions at least every 10 years. Therefore, he had hoped that they should have heard some little word dropped about this matter; but, perhaps, the silence that had been maintained upon it portended some great event that was looming in the distance. He hoped, however, the proposed opportunity of marking the progress of English arts and manufactures would not be lost to this Society and to the country. (Much applause.)

Mr. Chester said he had been requested by the Chairman of Council to say a very few words in reply to what had fallen from their colleague in the Council, Sir Joseph Paxton. It was hardly fair, he thought, to find fault with him (Mr. Chester) because he had said nothing about the proposed Exhibition of 1861. It had occupied a large share of the attention of the Council, and what had fallen from Sir Joseph Paxton came with as much force as if it had been stated by any other member of that body. Sir Joseph had told them that he had taken part in the deliberations on this subject, and certainly no one was more entitled than he was to speak upon it, and to act as the mouthpiece of the Council on such a matter. Therefore, all that Sir Joseph had said with regard to an Exhibition for 1861 should be taken as said by him as the representative of the Council, and he had no cause of complaint that the subject had not been introduced on the present occasion by any other member of that body. It was, however, a matter of some difficulty, and required a peculiar organisation. The present Council was near the end of its year of office, and he thought, having drawn up the cardinal features of the plan, those who would have to deal with the affairs of the Society in the ensuing year would most probably deal with this subject of the Exhibition of 1861.

Mr. Henry Thomas Hope said, up to this time they had had toasts which were more especially connected with the proceedings which had taken place during the day at the house of the Society; these, he must say, had been brought forward with a degree of eloquence which he had rarely heard excelled on such occasions. The toast he had to propose was of an abstract nature. It was that they should drink "Success to Arts, Manufactures, and Commerce," which was in itself a subject which even the most eloquent and powerful orators would find it difficult to do justice to within the limits of a speech on an occasion like this. He presumed this toast had arisen from the title which this Society bore. It had been called, for many years, "The Society for the Encouragement of Arts, Manufactures, and Commerce," and he believed the origin of that title dated from a time when Art was less understood and less appreciated than it was in the present day. The noble chairman had enlarged far more eloquently than he could do on the encouragement that art experienced in the present day, and he apprehended that now the duties of the Society were not so much connected with the encouragement of that which might be called high and abstract art, as with the peculiar application of art to manufactures and commerce. He recollected the time —and it was at no very remote period—when gentlemen of the highest eminence in art thought it was, to a certain degree, a compromise of their dignity to ap-

ply the principles of high art, in any degree, to the improvement of manufactures. They had, he thought, lived to see the day in which what he might venture to call a wider and more liberal view of things had prevailed; but the arts of sculpture, painting, architecture, and all high arts had formerly largely depended upon this Society for encouragement and promotion, and what they all delighted to see was the application of those arts to the promotion of commerce and manufactures. He believed it was owing in a great degree to this Society, and to gentlemen connected with it, that the country now had a Department of Science and Art. They knew, moreover, how much advantage the public had derived from the amount of education afforded by this department, as well as by the Society of Arts, to the class of artisans and manufacturers. At the same time, they must not imagine that they had nothing further to learn, and that they had arrived at the highest point in the application of art to matters of ordinary manufacture; nor must they flatter themselves that they had outstripped their neighbours. It was true they had made great strides, at the same time he believed the manufactured products of this country were, after all, made more with a view to supply the million than to accomplish great excellence in individual specimens. He had ventured to say those few words upon this subject as introductory to the toast which he had the honour to propose, and he would now give them—"Success to the Arts, Manufactures, and Commerce of the country," coupled with the name of Mr. John Dillon.

The toast was drunk with loud cheering.

Mr. Dillon briefly responded. Arts, Manufactures, and Commerce! These were large subjects to embrace; but this Society, he apprehended, sought chiefly to bring them together—to connect and form for them a means of communication and a point of union. The table at which he sat was inscribed "The Fine Arts and Architecture." But was not architecture itself a fine art? He now saw near him Mr. Owen Jones, and, when he looked at the magnificently "fretted roof" above him, he felt no difficulty in admitting that it was so. All the branches entertained by this Society—Art, Manufacture, and Commerce—varied as they might be, had one common object—the improvement of man and the amelioration of society; and, on the part of the supporters of each, having been called upon so to do, he begged to acknowledge the honour which had been done them.

The Master of the Mint then proposed "The Health of Chairman," which was received with loud cheering.

The Chairman said:—Gentlemen,—You have heard me already with so much patience upon the proper subjects of the evening; there have been so many good observations since, and the evening is now so far advanced, that I am happy to think I need not detain you longer; but thanking you from my heart for the cordiality of my reception, I can assure you, with all truth, that I estimate as I ought the honour of having presided upon such an occasion and over such a meeting. (Loud applause.)

ANNUAL GENERAL MEETING.

Wednesday, June 30, 1858.

The Annual General Meeting for receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held on Wednesday, the 30th inst., at 4 p.m., C. Wentworth Dilke, Esq., Chairman of Council, presided.

The Chairman, in opening the proceedings, said, that by the bye-laws, he was directed to nominate two gentlemen to act as scrutineers of the ballot for the election of officers. He would ask Messrs. W. Atkinson and P. L. Simmonds to undertake that office.

These gentlemen having consented to act, the Chairman declared the ballot open. He then called upon the Secretary to read the

ANNUAL REPORT.

In compliance with the terms of the Charter the Council now lay before the members the annual report of their proceedings.

Exemption from Rating.

The first subject in order of time is the Bill for amending the laws relating to the exemption of Mechanics' Institutions and other like Societies from local rates, which, at the date of the last report, was before the House of Commons. This Bill had been brought before the House of Commons at the instance of the Council, in compliance with the wishes of the Institutions in Union. The Bill was not passed; and under the circumstances detailed in the Secretary's report, read last Thursday to the Conference, and already published in the *Journal*, it has not been thought advisable to bring the subject forward again before the House.

Bye-laws.

In November last, when the Bye-laws relating to the appointment of the Board of Examiners came to be acted upon for the first time, it was found that they were not in accordance with the Charter, and the Council therefore suspended action upon them, and took steps for at once calling a general meeting of the Society for altering them, so as to place them in harmony with the Charter. Accordingly on the first day of December a special general meeting was held, and new Bye-laws, proposed by the Council in reference to the appointment of Examiners, were passed unanimously. A full report of this meeting will be found at p. 31 of the present volume of the *Journal*. The Council lost no time in acting upon their amended laws, and appointed a Board of Examiners, who have just completed most satisfactorily the Examinations of the present year.

Committees.

During the year the Council has sought and obtained the services of several committees on matters of considerable importance.

The subject of Gutta Percha, its great and growing importance in arts and manufactures, has for some time past attracted considerable attention in reference to its quality, purity, and its liability to decay under certain conditions. The Council have appointed a committee to investigate this subject, and to collect facts in reference to the sources of supply of gutta percha, its cultivation,—as well as the circumstances and conditions under which it

resists or yields to decay. This Committee has met several times, and has, for the purpose of obtaining facts in connection with this subject, addressed a circular of queries to all, whether in this country or abroad, who are likely to be able to furnish them with information.

Her Majesty's government have undertaken to circulate these queries among the residents in such districts as the Committee have pointed out as likely to have it in their power to supply the information. The East India Company have also most readily consented to act in the same manner as regards their territories.

The East India Company have, at the same time, furnished the Committee with specimens of a substance called "Pauchontee," the product of a tree of the same genus as that from which the gutta percha is produced. It remains to be seen whether this substance can be used as a substitute for, or in conjunction with, the true gutta percha. Experiments to determine this, as well as the nature and causes of the decay or failure in gutta percha, and the nature and effect of adulteration of it, will be undertaken by this Committee. Indeed, a series of experiments have been already devised, and will be commenced forthwith. The Council have much pleasure in recording the liberality of Messrs. Ford Barclay and Edward Highton, and the Submarine Telegraph Company, who have contributed, the two former £25 each, and the latter £10 10s., to assist in defraying the cost of these experiments. This Society naturally feels considerable interest in this subject, the first specimens of gutta percha introduced into this country having been sent here, and the Society's gold medal having been awarded to Dr. Montgomery for its introduction. The labours of this committee must necessarily extend over a considerable period of time, in order to practically test the substance under various conditions, and it is reasonable to expect that very valuable information will ultimately result from them.

The Dutch Government are at present turning their attention to the supply of this article from their possessions in the East, and have sent out a distinguished naturalist to explore those regions in search of it. A specimen of Gutta percha, the produce of Surinam, has been sent to the Society from one of its corresponding members, Dr. Bleekrode, of Leyden.

The subject of Artistic Copyright has been investigated by another Committee appointed by the Council. This Committee has Sir Charles Eastlake, P.R.A., for its Chairman; Mr. J. L. Lewis, late president of the Society of Painters in Water Colours, its Deputy Chairman, with Mr. D. Roberton Blaine, barrister-at-law, for its Reporter, and is composed of eminent Painters, Sculptors, Architects, Photographers, Engravers, Purchasers, Publishers, and others interested in works of Fine Art. At the request of the Committee, Mr. Blaine drew up a very useful statement in reference to the existing state of the law as affecting copyright on Works of Art, which the Council published and circulated. Queries were also circulated for the purpose of eliciting facts, illustrating the grievances under which artists and the public laboured in consequence of the defective state of the law. These queries soon brought the Committee a considerable amount of information, and they at once proceeded to deal with it. The result was a valuable report, already published in the *Journal*, p. 293, suggesting those remedies to be sought for from the legislature, and these have been embodied in a proposed Bill. A petition, under the seal of the Society, in favour of an amendment of the law of Artistic Copyright, as well as one signed by eighty leading painters, sculptors, architects, purchasers, publishers, and others interested in the Fine Arts, were yesterday placed in the hands of Lord Lyndhurst, who has kindly undertaken to present them to the House of Lords, and move for the appointment of a Committee to inquire into the question, with a view of legislating upon it. Whether this can be accomplished during the remainder of the present session is doubtful, but the subject will come forward early in the next. There are considerable difficulties in dealing with this matter, but the labours of the Society's Committee, the discussion which has there taken place upon every point amongst men so qualified to treat it in all its bearings, resulting in the adoption of a report most carefully considered, cannot fail to have placed the matter in a position more favourable for practical legislation than it has hitherto attained.

The Council has also appointed a Committee to investigate the subject of Mechanical Contrivances applied to Medicine and Surgery—to promote improvement in their production—to determine and make known desiderata—to examine and report on the merit of apparatus submitted, and to recommend rewards for successful inventions. This Committee is presided over by Mr. James Luke, F.R.S., and is composed of a large number of eminent physicians and surgeons. They have divided themselves into sub-Committees under the following heads:

General Medicine.
General Surgery.
Dental Surgery.
Obstetric Surgery.
Ophthalmic Surgery.
Orthopædic Surgery.
Philosophical Apparatus, applied to the investigation and treatment of disease.
Veterinary Surgery.

Dr. Watson, Dr. Budd, and Messrs. Henry Charles Johnson and Richard Partridge, have been chosen Deputy-Chairmen, with Messrs. F.

Seymour Haden and Mitchell Henry, as Reporters of the Committee.

The importance of the establishment of Suburban Galleries of Science and Art has engaged the attention of the Council, who have appointed a Committee to investigate the matter, and report on the practicability of forming such galleries, and supporting such collections not only in suburban districts but in the provinces. This Committee will shortly make its report.

Three years ago the Council appointed a Committee in reference to the expediency of the establishment of a Small Parcels Post. That Committee held several meetings, and by permission of the Postmaster-General, had the opportunity of personally inspecting the arrangements for the receipt and sending out of the letters. The Committee had agreed on the principles of its report, but for reasons which it is unnecessary for the Council to enter upon here, it was considered advisable not to bring the matter forward at that time. The Council have this Session reappointed that Committee, which has since made its report, and instructions have been given for its publication in the *Journal.* The subject is one of great interest to the public at large, and the Council have decided on inviting the Institutions in Union to express their opinion as to whether the Council should urge upon the Post-office authorities the adoption of the system.

A sum of £20 was, during the session, placed in the hands of the Council by the Rev. F. Trench and J. MacGregor, Esq. (to which the Council added the Society's Medal), to be awarded as a Prize for a Writing Case, suited for the use of soldiers, sailors, emigrants, &c. The attention of the competitors was called to lightness, smallness of size, the avoidance (if possible) of fluid ink, durability, cheapness with a guaranteed supply, and general applicability to the duties, habits, and requirements of the above classes. Sixty-two cases were received in competition, but the Council regret that, after a careful examination of them, none appeared to possess sufficient merit to justify them in awarding the prize.

The Council have determined to invite a further competition, and the conditions will be shortly announced.

During the last few days the Council has had communicated to them a process, the invention of an Englishman, for the production of the metal Aluminium, at a very reduced cost, such a cost, indeed, as will enable the metal to be brought into the market at a price which would admit of its being largely used, either in substitution of higher-priced metals, or for purposes to which such metals now are inapplicable by reason of their weight. A small committee has been appointed to investigate the process and report on its efficiency. It is needless for the Council to dwell on the importance of the cheap production of a metal possessed of such valuable qualities as Aluminium.

Financial Prize Essay.

The Society will recollect that one of its members, Mr. Henry Johnson, some time since, placed in the hands of the council the sum of two hundred guineas as a prize to be awarded for "The best essay on the present financial position of the country as affected by recent events, in which the principle of a sinking fund should be discussed, and also an investigation made as to the best mode of gradually liquidating the National Debt." Twenty-two Essays have been sent in competition. The Council appointed three adjudicators to award the prize. Professor Charles Neate, of Oxford, Professor Waley, of University College, London, and Mr. J. T. Danson, Fellow of the Statistical Society. The Council had hoped that they might have been enabled to have reported the results of these gentlemen's labours, but there still remain some essays to be read, and the decision is therefore delayed. The award will, however, be made shortly, and as soon as it is, the decision will be announced in the *Journal.* The Council cannot quit this subject without reporting the continued liberality of Mr. Johnson, who has placed in the hands of the Council a further sum of seventy-five guineas for the purpose of placing in the hands of each adjudicator a fee of twenty-five guineas for his trouble in deciding on the merits of the competing Essays.

Marine Algæ Prizes.

The Council, in their report of last year, informed the members that prizes of £50 and £20 respectively, had been placed in their hands by Sir W. C. Trevelyan, Bart., to be awarded for "The two best and approved Essays on the applications of Marine Algæ and their products, as food or medicine for man and domestic animals. Competitors must give the results of their original investigations on sea-weeds (especially on the chemistry of their nutrient principles); and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the nutritive species in a state fit for food. Mere compilations will not be admitted to competition." The Council regret to say that at the time appointed no essay was sent in. Dr. McGowan, of Ningpo, in reference to this subject, presented to the Society a series of specimens of algæ, as prepared for use by the Chinese. A notice of them appeared in the *Journal.* An interesting communication, by Mr. P. L. Simmonds, on the Economic Uses of the Marine Algæ, will be found at p. 362, in the last volume of the *Journal.*

Colonies.

During the past session the Council have received from the Chamber of Commerce in West-

ern Australia specimens of dried raisins and olive oil, the produce of that colony. Both have been reported upon by gentlemen engaged in the importation of such articles, and they are pronounced to be of a high character.

Address to H.R.H. the President.

On the occasion of the marriage of Her Royal Highness the Princess Royal with His Royal Highness the Prince Frederick William of Prussia, the Council called upon the Society and the Institutions in Union to join in an address of congratulation to His Royal Highness the President. The address, with upwards of ten thousand signatures attached to it, was presented to H.R.H. by a deputation of about two hundred members of the Society and Presidents of the Institutions in Union, headed by Mr. C. Wentworth Dilke, the Chairman of the Council. His Royal Highness was pleased to receive the Deputation most graciously, and to make a reply which has already been published in the *Journal*.

Exhibition in 1861.

The Council have had under their anxious consideration, at several meetings specially summoned, the benefits to be derived from periodical Exhibitions of Industry and Art, and have come to the following resolutions :—

The Council of the Society of Arts, bearing in mind the part which the Society took in originating the Great Exhibition of 1851, have considered it to be their duty carefully to examine various suggestions for holding an Exhibition in 1861, which have been submitted to them, and have resolved :—

1. That the institution of Decennial Exhibitions in London, for the purpose of showing the progress made in Industry and Art during each period of ten years, would tend greatly to the "Encouragement of Arts, Manufactures, and Commerce."
2. That the first of these exhibitions ought not to be a repetition of the Exhibition of 1851, which must be considered an exceptional event, but should be an Exhibition of works selected for excellence, illustrating especially the progress of Industry and Art, and arranged according to classes, and not countries; and that it should comprehend Music and also Painting, which was excluded in 1851.
3. That Foreigners should be invited to exhibit on the same conditions as British Exhibitors.
4. That the Council will proceed to consider how the foregoing resolutions can be best carried into effect.

After publishing these resolutions, the Council did not consider it necessary, as their year of office was nearly expired, to take further steps, being of opinion that such steps devolved more appropriately on their successors.

Exhibition of Inventions.

The Tenth Annual Exhibition was opened on Easter Monday, and the Council have great pleasure in informing the members that the Exhibition was of an improved character, and that a much larger number of Exhibitors came forward than in previous years. The Exhibition was visited by upwards of five thousand persons.

Conversazioni.

Two Conversazioni have been held during the session, one at the Society's House, during the Exhibition of Inventions, and the other at the South Kensington Museum. This latter was attended by members and their friends, ladies as well as gentlemen, and two thousand two hundred and eighty persons were present. The Council have taken occasion to address to the Lords of the Committee of Council on Education, under whose charge the Museums at Kensington are placed, a letter, in which they availed themselves of the opportunity to state how highly, on public grounds, and in the interests of "Arts, Manufactures, and Commerce," the Society appreciates the wise liberality which has characterised the regulations laid down by the Committee of Council in respect of the public uses of the Museum at South Kensington, open on certain evenings of each week to the general public, free of charge; on certain other evenings of each week it may be visited at a small expense by Societies which promote Art, Science, or Education.

The creation and maintenance of museums and similar establishments, at the expense of the public, can only be justified when they are open as fully and freely as possible to the use of the public; and there are large masses of persons, quite capable of profiting by visits to museums, who are practically debarred from using them if they are closed during the evening. The Council expressed its earnest hope that the success of the great experiment which their Lordships had tried, might lead to the adoption of the same wise liberality in other departments.

Mulready Drawings.

The members of the Society may be reminded that a few years since the Society of Arts proposed to assist in the formation of a National Gallery of Art, and to raise funds for that purpose by holding annually an exhibition of the works of some one living artist. At that period there were few if any pictures of living artists in the National Gallery. Mr. Vernon, Mr. Turner, and Mr. Sheepshanks, had not then presented collections. In 1848, the works of Mr. Mulready, R.A., were exhibited by the Society, but the surplus funds, after the payment of the expenses, did not amount to a sum sufficient for the purchase of a picture by Mr. Mulready, as had been intended in the first instance.

Mr. Mulready, in the course of the present session, has, however, with great liberality, presented to the Council three drawings from the life, two in chalks and one by the pen, in return for the surplus which was handed to him, a sum wholly inadequate as representing the value of the drawings, which by competent judges are pronounced to be studies which have been rarely equalled in modern times. The Council offered

them to the trustees of the National Gallery upon the following terms, viz., "That when they are not publicly exhibited in London, they may be lent by the trustees to Local Schools of Art for limited periods, for the purposes of instruction, under such restrictions as the trustees may consider necessary."

The trustees, however, did not feel themselves in a position to accept the drawings on those conditions, and the conditions were therefore withdrawn. The drawings were thereupon accepted by the Trustees, and are now exhibited with other works of the British School at Marlborough House.

Medals.

The Council, under the advice of their Committees, have awarded the following medals :—

To Mr. William Williams, for his "Machine for Cutting and Dressing Stones for Building Purposes. *The Society's Silver Medal.*

To Mr. J. W. Wilson, for his "Combination of the tubular gouge and disc-paring tool for wood-shaping machinery." *The Society's Silver Medal.*

Evening Meetings.

The evening meetings during the session have been well attended. The Papers read, and the subsequent discussions, have been of a character which will bear comparison with any previous session. It is needless to enter into further particulars in regard to them, as the papers have all appeared in the Society's Journal.

The Council have awarded the following medals :—

To Dr. J. Forbes Watson, for his Paper "On the Composition and Relative Value of the Food Grains of India." *The Society's Silver Medal.*

To Mr. John Underwood, for his Paper "On the History and Chemistry of Writing, Printing, and Copying Inks, and a new plan of taking manifold copies of written and printed documents, &c." *The Society's Silver Medal.*

To Mr. J. Algernon Clarke, for his Essay* "On the Application of Steam-power to the Cultivation of the Soil." *The Society's Silver Medal.*

To Mr. Wm. Stones, for his Paper "On New Zealand and its Resources." *The Society's Silver Medal.*

To Mr. A. G. Findlay, for his Paper "On the Progress of the English Lighthouse System." *The Society's Silver Medal.*

To Mr. F. R. De la Tréhonnais, for his Paper "On the past and present of French Agriculture." *The Society's Silver Medal.*

To Professor John Wilson, F.R.S.E., for his Paper "On Canada: its Productions and Resources." *The Society's Silver Medal.*

Union of Institutions.

For the particulars of what has been doing in this branch of the society's action, the Council must refer the members to the report of their Secretary, read to the conference on Thursday last, and published in last week's *Journal.* The Council congratulate the Society on the satisfactory results of the Examinations which have just taken place, the statistics of which are already before the members. A Prize Fund, amounting to £222 17s., has been subscribed during the present year, a list of the contributions to which fund has already been published, and will be found at page 399 of the present volume of the *Journal.* The Council, in the name of the Society, tender their best thanks to those gentlemen for their liberality.

Finance.

Appended to this Report are the annual accounts of the Society, which are already in the hands of members, having been, in accordance with the Bye-laws, published in last week's *Journal.*

It will be observed that the present account differs in regard to one item from the form hitherto adopted, and the change has been made because in the opinion of the Council the present statement gives a more just view of the finances of the Society.

In former years, in ascertaining the income of the Society for the year, it had been usual to take a certain proportion of the subscriptions in arrear, and add them to the receipts proper for the year. Seeing, however, that there must always, at the time of taking the accounts, be arrears, it has been thought the fairest and simplest plan to adopt the sum actually received as the income for the year. This has now been done, the amounts in arrear being entered in the inner margin and not carried out. The income, therefore, appears smaller than it would have done had the form used in former years been adopted. The result shows a balance of expenditure over receipts of £48 11s., instead of a balance the other way of several hundred pounds. It must not be imagined, however, that because there is a small balance of expenditure over receipts that the Society is in reality exceeding its income, for it will be seen that one item on the expenditure side of the account is £250 paid in discharge of the last instalment on the debenture due to the Messrs. Twining. The Society is now free from debenture debt. The statement of assets and liabilities shows the improved position of the Society; the excess of assets over liabilities in May, 1858, being £3,953 2s. 5d., as compared with £3,140 4s. 2d., in May, 1857. A portion of this increase is derived from the fact that the Acton Trust, £536 3s. 10d., has been released from its special object, and is now available for the general purposes of the Society. The higher price of Consols this year

* This Essay was sent in competition for the Medal offered in the Society's Premium List.

as compared with last, also tends to swell the amount.

While the Council point with satisfaction to the present financial position of the Society, they desire to call the attention of the members to the fact, that there has been a decrease in the actual number of members on the books, arising not so much from an increase in the proportion of those who, from death or otherwise, cease to be connected with the Society, as from a smaller number of members having during the past year been added to the list. The Society has never been more active, and the Council invite the members generally to use their best exertions to increase the number on the Society's register.

Though not strictly belonging to the financial statement of the present year, and not included in it, the Council cannot pass over in silence the bequest of £100 made to the Society by the late Richard Horsman Solly, Esq., one of the oldest, and, until of late, one of the most active members of the Society. This legacy, less 10 per cent. duty, has been received since the closing of the accounts. A notice of Mr. Solly appeared in the *Journal* at the time of his death, which renders it unnecessary now to repeat what was then said.

The Secretary then read the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, which was published in the last number of the *Journal*, page 498.

Mr. EDWARD HIGHTON moved the adoption of the report, which was seconded by Mr. C. MASTERS.

Mr. F. LAWRENCE said, he wish to propose an amendment, to the effect that the meeting, while adopting the report, desired to express a hope that in the next session more attention would be devoted to the encouragement of Arts, Manufactures, and Commerce, than, as he gathered from the report which had just been read, had been the case during the session just closed. He considered, looking at the balance-sheet, that too large a portion of the funds of the society had been devoted to the educational branch. He did not object to education forming one of the Society's objects, but he thought it ought not to engross so large a portion of its attention and funds. The energies of the council seemed to be almost entirely devoted to this subject, whilst the promotion of arts, science and manufacture was left almost exclusively in the hands of the committees. As an illustration, he would refer to the small sum spent by one of these committees—that engaged upon the subject of Gutta Percha, which he believed had only met once, and had done little or nothing.

Mr. EDWARD HIGHTON, as Chairman of the Gutta Percha Committee, could not allow this statement to pass uncontradicted. The Committee had held many meetings, and had prepared and circulated, extensively, both at home and abroad, such papers as they considered necessary for obtaining the information they desired. They had already received valuable information from the East India Company and other sources, and had arranged a series of experiments which would probably extend over several years.

Mr. HARRY CHESTER said that, so far from the subject of education occupying the whole attention of the Council, he, for his own part, being specially interested in that question, often found it extremely difficult to obtain the ear of the Council when desirous of bringing forward matters relating to it, so much was their time taken up with the other objects of the Society. He might point to the resolutions passed in reference to the intended Exhibition in 1861, the discussion upon which alone had, he could assure them, taken up the whole of several unusually prolonged Council meetings.

The CHAIRMAN gave an account, in some detail, of the proceedings of the several committees, through which means only was it possible that the multifarious objects of the Society could effectually be carried out. He drew particular attention to the Artistic Copyright Committee, which had held fourteen meetings, and the importance of whose labours could hardly be overrated.

Mr. P. L. SIMMONDS called attention to the important influence which was exercised by the society through its Premium List. He had thought in former years with Mr. Lawrence, that the Society had devoted an undue share of attention to the subject of education, but he was of opinion that during the past session this charge could not fairly be brought against the council. He was aware how much had been done with a view to obtain information in reference to the products of our Colonies, and if the circulation of the Premium List failed to elicit that amount of response which might have been reasonably anticipated—the council were certainly not to blame. Bearing in mind the peculiar circumstances in which the present council and its chairman had been placed at the commencement of the session, he thought, for his part, that they had done their work well, and he was sure the Society would feel that great praise was due to them.

Mr. LAWRENCE said that nothing was further from his intention than to raise dissension in the meeting. He had only brought forward his amendment in order to afford opportunity for discussion, and he now desired to withdraw it.

The CHAIRMAN then put the motion to the meeting, when the report was unanimously adopted.

Mr. THOMAS WINKWORTH said he believed he was the oldest member of the Society present, and having had the opportunity, as one of its vice-presidents, of observing the zeal and intelligence with which the Chairman of Council had performed the duties of his office, he thought the meeting ought not to separate without expressing their thanks to him in a formal resolution.

The CHAIRMAN here interposed, stating that he thought the course Mr. Winkworth was taking was irregular, and tended to establish an undesirable precedent.

Mr. WINKWORTH thought the peculiar circumstances of the case justified him in pressing the motion; he should therefore move

That the cordial thanks of this meeting be given to C. Wentworth Dilke, Esq., Chairman of Council, for his valuable services and unremitting attention to the interests of the Society during his period of office.

Mr. MATTHEW MARSHALL, in seconding the resolution, desired to take the opportunity of his own retirement from the Council to bear his testimony to the very remarkable manner in which their chairman had devoted himself to the interests of the Society.

Mr. HARRY CHESTER desired to express his cordial concurrence in this resolution.

Mr. F. LAWRENCE wished also to express his high appreciation of Mr. Dilke's valuable services to the Society.

Mr. ATKINSON spoke to a similar effect.

Mr. WINKWORTH then put his motion to the meeting, and it was carried by acclamation.

The CHAIRMAN acknowledged the compliment which had been paid him.

It was then moved, seconded, and resolved,

That it be recommended to the Council to present to each of the Institutions in Union, a copy of the speeches and ad-

dresses of His Royal Highness the Prince Consort, President of the Society.

It was then moved by Mr. R. Williams, and seconded by Mr. J. Bell Sedgwick.

That the thanks of the Society be given to the Council for their services during the past year, and that this meeting desires to testify the satisfaction which the members derived from the Conversazione at the South Kensington Museum.

This resolution was then put to the meeting and carried unanimously.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following noblemen and gentlemen had been unanimously elected to fill the several offices. The names in *italics* are those of members who have not, during the past year, filled the offices to which they have been elected.

COUNCIL.

PRESIDENT.

H.R.H. Prince Albert, F.R.S., &c., &c.

VICE-PRESIDENTS.

Lord Ashburton, F.R.S.
W. H. Bodkin.
William Brown, M.P.
Harry Chester.
Henry Cole, C.B.
C. Wentworth Dilke.
William Fairbairn, F.R.S.
Thomas Graham, F.R.S., Master of the Mint.
Joseph Glynn, F.R.S.
The Earl Granville, F.R.S.
Henry Thomas Hope.
Marquis of Lansdowne.
The Right Hon. Sir J. Pakington, Bart., M.P.
Sir Joseph Paxton, M.P.
John Scott Russell, F.R.S.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
William Tooke, F.R.S.
Thomas Twining, Jun.
Thomas Winkworth.

OTHER MEMBERS OF COUNCIL.

Thomas Dyke Acland.
Thomas King Chambers, M.D.
J. Griffith Frith.
Peter Graham.
W. R. Grove, Q.C., F.R.S.
William Hawes.
George Moffatt, M.P.
Lieut.-Col. H. C. Owen, R.E., C.B.
Sir Thomas Phillips, F.G.S.
F. R. Sandford.
Thomas Sopwith, F.R.S.
George Fergusson Wilson, F.R.S.

TREASURERS.

J. C. Macdonald. | *W. Mackrell.*

AUDITORS.

J. G. Appold, F.R.S. | *Samuel Redgrave.*

SECRETARY.

Peter Le Neve Foster, M.A.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

At the conclusion of the General Meeting, an Ordinary Meeting, specially called for the election of members, was held, at which C. Wentworth Dilke, Esq., Chairman of the Council, presided.

The following gentlemen were balloted for and duly elected members of the Society:—

Adé, George.
Arding, Charles Bennett.
Clutton, Owen.
Constable, Rev. W. J. R.
Daniell, Richard Percival.
Eddison, Edwin.
Johnson, Edmund Charles, M.D.
Johnson, Henry Charles.
Luke, James, F.R.S.
Simons, Edward.
Vigers, Robert.
Wingfield, Hon. Lewis S.

DECIMAL COINAGE.

The following table, with the subjoined explanations, has been communicated by Lieut.-General Sir Charles Pasley, K.C.B.:—

TABLE FOR REDUCING STERLING COINS TO THE NEW DECIMAL COINAGE.

Sterling.			Decimal.			Sterling.			Decimal.			Sterling.			Decimal.			Sterling.			Decimal.		
S.	d.	f.	Fl.	c.	m.	S.	d.	f.	Fl.	c.	m.	S.	d.	f.	Fl.	c.	m.	S.	d.	f.	Fl.	c.	m.
0	0	1	0	0	1	1	0	1	0	5	1	2	0	1	1	0	1	3	0	1	1	5	1
0	0	2	0	0	2	1	0	2	0	5	2	2	0	2	1	0	2	3	0	2	1	5	2
0	0	3	0	0	3	1	0	3	0	5	3	2	0	3	1	0	3	3	0	3	1	5	3
0	1	0	0	0	4	1	1	0	0	5	4	2	1	0	1	0	4	3	1	0	1	5	4
0	1	1	0	0	5	1	1	1	0	5	5	2	1	1	1	0	5	3	1	1	1	5	5
0	1	2	0	0	6	1	1	2	0	5	6	2	1	2	1	0	6	3	1	2	1	5	6
0	1	3	0	0	7	1	1	3	0	5	7	2	1	3	1	0	7	3	1	3	1	5	7
0	2	0	0	0	8	1	2	0	0	5	8	2	2	0	1	0	8	3	2	0	1	5	8
0	2	1	0	0	9	1	2	1	0	5	9	2	2	1	1	0	9	3	2	1	1	5	9
0	2	2	0	1	0	1	2	2	0	6	0	2	2	2	1	1	0	3	2	2	1	6	0
0	2	3	0	1	1	1	2	3	0	6	1	2	2	3	1	1	1	3	2	3	1	6	1
0	3	0	0	1	3	1	3	0	0	6	3	2	3	0	1	1	3	3	3	0	1	6	3
0	3	1	0	1	4	1	3	1	0	6	4	2	3	1	1	1	4	3	3	1	1	6	4
0	3	2	0	1	5	1	3	2	0	6	5	2	3	2	1	1	5	3	3	2	1	6	5
0	3	3	0	1	6	1	3	3	0	6	6	2	3	3	1	1	6	3	3	3	1	6	6
0	4	0	0	1	7	1	4	0	0	6	7	2	4	0	1	1	7	3	4	0	1	6	7
0	4	1	0	1	8	1	4	1	0	6	8	2	4	1	1	1	8	3	4	1	1	6	8
0	4	2	0	1	9	1	4	2	0	6	9	2	4	2	1	1	9	3	4	2	1	6	9
0	4	3	0	2	0	1	4	3	0	7	0	2	4	3	1	2	0	3	4	3	1	7	0
0	5	0	0	2	1	1	5	0	0	7	1	2	5	0	1	2	1	3	5	0	1	7	1
0	5	1	0	2	2	1	5	1	0	7	2	2	5	1	1	2	2	3	5	1	1	7	2
0	5	2	0	2	3	1	5	2	0	7	3	2	5	2	1	2	3	3	5	2	1	7	3
0	5	3	0	2	4	1	5	3	0	7	4	2	5	3	1	2	4	3	5	3	1	7	4
0	6	0	0	2	5	1	6	0	0	7	5	2	6	0	1	2	5	3	6	0	1	7	5
0	6	1	0	2	6	1	6	1	0	7	6	2	6	1	1	2	6	3	6	1	1	7	6
0	6	2	0	2	7	1	6	2	0	7	7	2	6	2	1	2	7	3	6	2	1	7	7
0	6	3	0	2	8	1	6	3	0	7	8	2	6	3	1	2	8	3	6	3	1	7	8
0	7	0	0	2	9	1	7	0	0	7	9	2	7	0	1	2	9	3	7	0	1	7	9
0	7	1	0	3	0	1	7	1	0	8	0	2	7	1	1	3	0	3	7	1	1	8	0
0	7	2	0	3	1	1	7	2	0	8	1	2	7	2	1	3	1	3	7	2	1	8	1
0	7	3	0	3	2	1	7	3	0	8	2	2	7	3	1	3	2	3	7	3	1	8	2
0	8	0	0	3	3	1	8	0	0	8	3	2	8	0	1	3	3	3	8	0	1	8	3
0	8	1	0	3	4	1	8	1	0	8	4	2	8	1	1	3	4	3	8	1	1	8	4
0	8	2	0	3	5	1	8	2	0	8	5	2	8	2	1	3	5	3	8	2	1	8	5
0	8	3	0	3	6	1	8	3	0	8	6	2	8	3	1	3	6	3	8	3	1	8	6
0	9	0	0	3	8	1	9	0	0	8	8	2	9	0	1	3	8	3	9	0	1	8	8
0	9	1	0	3	9	1	9	1	0	8	9	2	9	1	1	3	9	3	9	1	1	8	9
0	9	2	0	4	0	1	9	2	0	9	0	2	9	2	1	4	0	3	9	2	1	9	0
0	9	3	0	4	1	1	9	3	0	9	1	2	9	3	1	4	1	3	9	3	1	9	1
0	10	0	0	4	2	1	10	0	0	9	2	2	10	0	1	4	2	3	10	0	1	9	2
0	10	1	0	4	3	1	10	1	0	9	3	2	10	1	1	4	3	3	10	1	1	9	3
0	10	2	0	4	4	1	10	2	0	9	4	2	10	2	1	4	4	3	10	2	1	9	4
0	10	3	0	4	5	1	10	3	0	9	5	2	10	3	1	4	5	3	10	3	1	9	5
0	11	0	0	4	6	1	11	0	0	9	6	2	11	0	1	4	6	3	11	0	1	9	6
0	11	1	0	4	7	1	11	1	0	9	7	2	11	1	1	4	7	3	11	1	1	9	7
0	11	2	0	4	8	1	11	2	0	9	8	2	11	2	1	4	8	3	11	2	1	9	8
0	11	3	0	4	9	1	11	3	0	9	9	2	11	3	1	4	9	3	11	3	1	9	9
1	0	0	0	5	0	2	0	0	1	0	0	3	0	0	1	5	0	4	0	0	2	0	0

The above Table is intended for the general use of men of business and others, in the event of the decimal coinage being established; and may be comprised in a space of six inches in height by 4½ in width, of a convenient size, if printed on a card, to be hung up in shops or offices; or it may be printed on opposite pages of a small book, with the numeral figures of the same size as those of the columns of numbers of the "Ready Reckoner." But as the great advantage of decimal notation will be its very soon dispensing with the use of tables altogether, I shall annex the following—

Rules for Reducing Sterling Money to the Proposed Decimal Coinage, off-hand, by Mental Arithmetic.

You must first reduce your sterling money from shillings into florins and farthings, when there is an even number of shillings, or into so many florins, one shilling, and so many farthings, when there is an odd number of shillings, estimating each florin at 100 mils, and one shilling at 50 mils.

Thus, for example, 2s. 2½d. will be equal to 1 florin 10 farthings = 100 mils + 10 farthings; and 3s. 3¾d. will be equal to 150 mils + 15 farthings; 12s. 7½d. will be equal to 6 florins 30 farthings; 13s. 10¼d. will be equal to 650 mils + 41 farthings; 18s. 4½d. will be equal to 900 mils + 18 farthings; and 19s. 10¾d. will be equal to 950 mils + 43 farthings.

It now only remains to reduce all the farthings in 1 shilling, from ¼d. to 11¾d., 47 in number, into their equivalent value in mils, which may be done by the following rule:—

All sums from ¼d. to 2¾d., or from 1 to 11 farthings inclusive, must be reckoned equal to the same number of mils, which each of them exceeds only by $\frac{1}{24}$th part of of its own value.

All sums from 3d. to 8¾d., or from 12 to 35 farthings inclusive, must be reckoned equal to the same number of mils + 1, that is, to from 13 to 36 mils, 1 being the correction necessary for reducing the farthings into mils.

All sums from 9d. to 11¾d., or from 36 to 47 farthings inclusive, must be reckoned as the same number of mils + 2, that is from 38 to 49 mils, 2 being the correction necessary in this case.

Hence, 2s. 2½d. will be equal to 100 mils + 10 farthings, or to 110 mils.

3s. 3¾d. will be equal to 150 mils + 15 farthings = 150m. + 15m. + 1m., 1 being the correction necessary for reducing the farthings into mils. Total, 166 mils.

12s. 7½d. will be equal to 600 mils + 30 farthings = 600m. + 30m. + 1m., 1 being the correction necessary in this case. Total, 631 mils.

13s. 10¼d. will be equal to 650 mils + 41 farthings = 650m. + 41m. + 2m., 2 being the correction necessary in this case. Total, 693 mils.

18s. 4½d. will be equal to 900 mils + 18 farthings = 900m. + 18m. + 1m., 1 being the correction necessary in this case. Total, 919 mils.

19s. 10¾d. will be equal to 950 mils + 43 farthings = 950m. + 43m. + 2m., 2 being the correction necessary in this case. Total, 995 mils.

TYPE MAP.

A telegraphic map of Europe, entirely executed in typography, has been presented to the Society by Mr. R. Decker, of the Royal Printing Office, Berlin. It is the work of Mr. A. Mahlan, who is employed by Mr. Decker in the above establishment. It is remarkably clear and beautiful. The process by which it has been produced is described as follows:—The drawing of the map, made on paper, is blackened at the back with a carbonic tracing composition, and is placed, blackened side downwards, on a surface composed of quadrats, formed each by sixteen nonpareil squares, and by means of a point the lines are transferred to them. The quadrats over which the lines are traced are then exchanged for nonpareil type, cast with a face of points, and the coast line is formed by the inner portion of these points being cut away. The telegraphic lines are formed of brass rules, fixed in nonpareil type body, as a sort of legs, which can be inserted into the composition, when needed, by taking out the quadrat, the legs being so adjusted in length that the upper edge of the rule is level with the face of the type. The additional shading of the coast line is effected by the insertion of nonpareil type cast with points on the face. The names of places are inserted by means of type taking the place of the quadrats where required.

The effect produced is peculiarly good. How far this is ever likely to supersede the present methods of producing maps by engraving and transfer to lithographic stone, is questionable; no details as to the cost are given, and it seems very doubtful (however simple the process appears), whether the result can be satisfactorily produced except by a skilled workman, whose labour must be adequately remunerated.

SOUTH KENSINGTON MUSEUM.

During the week ending 26th June, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,928; on Monday and Tuesday (free evenings), 3,185. On the three Students' days (admission to the public 6d.), 939; one Students' evening, Wednesday, 104. Total, 7,156.

Home Correspondence.

ELECTRO-MAGNETISM AS A MOTIVE POWER.

SIR,—In the paper read before the Society some time since, by Mr. Thomas Allan, this subject does not appear to have had fair play, either from the author of the paper or from the several gentlemen who took part in the discussion. Mr. Allan did not bring out in sufficient prominence his improvements in electro-magnetism, and in his mechanical appliances for the most effective application of the power obtained; consequently, the discussion was not directed, as it probably otherwise would have been, to the consideration of those points which most vitally affect the success of electro-magnetism as a motive power.

The remarks of the gentlemen who took part in the discussion could not be said to be altogether unfriendly, although they appeared to be generally of a depreciatory character. Perhaps, after all, this highly conservative spirit or strong bias in favour of existing systems, and to depreciate new inventions, may be one of the wise provisions of nature, inasmuch as inventors are stimulated to redouble their exertions much more effectually by opposition, than they would be by the most flattering encomiums passed upon their ingenuity.

Unfortunately, however, the discussion upon Mr. Allan's paper did not so grapple with the real merits of the subject as to show any points to which his attention might be directed, with a view to future improvements.

Mr. Hearder's remarks were principally directed to the law of the squares, but however desirable it may be as a theoretical problem to ascertain precisely in what ratio the magnetic power decreases by an increase of distance, still the solution of this problem had nothing whatever to do with Mr. Allan's paper.

Mr. Siemens is too great a lover of science intentionally to throw any impediment in the way of improvement. He, however, made an objection to Mr. Allan's mechanical arrangements, which does not appear to be very sound. He stated that a "serious loss of power resulted from the sudden stoppage of the armatures in their descent." A locomotive travelling at the rate of sixty miles an hour with a five feet driving wheel, will not only stop the motion of the piston, but reverse the motion nearly twelve times in a second. In Mr. Allan's machine the motion is stopped but not reversed, so that, in this respect, his machine has an advantage over the reciprocating motion of the steam piston, and it does not appear that Mr. Siemens' objection really has much weight, although it had its effect upon the audience.

Several of the gentlemen who took part in the discussion were anxious for data, to institute a comparison with the steam-engine in its highly improved state. This extravagant expectation cannot at present be gratified. Would it not be more reasonable to compare the most advanced electro-motive machine with the steam-engine when Watt took it in hand, and before he had found a Bolton to assist him with capital? Had Watt not found a capitalist, he might have died and made no sign, and the gigantic improvements resulting from his genius would have remained undeveloped.

The machine which Mr. Allan brought before the Society of Arts was the first of the kind which he constructed, and it necessarily has many of the imperfections of a first attempt. Mr. Allan has materially improved his mechanical and electrical arrangements, and I cannot but think there is here an excellent opportunity for some capitalist who may be ambitious to associate his name with the solution of one of the greatest practical problems of the age.

The question is confessedly a very great one, and admits of a division of labour, and if chemists would turn their attention to the discovery of a cheaper substance

to supersede the zinc in the battery, a material point would thus be gained.

I think the three following improvements may be justly claimed by Mr. Allan, though they were very much lost sight of in the discussion:—

1st. The application of the magnetic force direct and not tangentially.

2nd. The use only of the most powerful portion of the geometric curve formed by the rapidly decreasing magnetic power in proportion to distance.

3rd. The continuation of motion or stroke in the same direction over any required space by means of successive groups of magnets.

I am aware that these points cannot well be understood without an explanatory diagram, but I will endeavour to explain how a model might be constructed which would illustrate these three points.

Let us suppose that three groups of four magnets each will be sufficient for illustration. Cotton reels will very aptly represent magnets with the wire coil; four reels gummed on to a card placed in such a manner as to form a square, but not quite touching each other. Let three of these be formed to represent three groups of magnets, and place them in a frame, so that there shall be rather more than two inches between the first and second, and rather more than three inches between the second and third, numbering downwards. Pierce a hole in the centre of the square formed by each set of reels and pass a slight straight piece of wood, about the substance of a black lead pencil, but longer, through these holes. Cut out three cardboard circular discs, sufficiently large to extend over the ends of the four reels, forming a group, and through a hole in the centre of these discs pass the piece of wood, and place stops upon it by passing a short pin through it, or otherwise, so that the discs may not pass below these stops, but the stops must be made so as to pass through the card to which the reels are attached, and the stops must be so arranged as to distance, that when the discs are placed upon the rod, and the rod passed through the several groups of reels, the upper disc will be one inch above the upper group of reels, two inches above the second group, and three inches above the third group. The apparatus being thus arranged, let us suppose that the upper group of electro-magnets are magnetised, and attract and pull down the upper disc to the upper surface of the first group of magnets, when the electricity is cut off, and as this motion of the vertical rod brings the second disc within one inch of the surface of the second set of magnets, these are then magnetised, and pull down the second disc, and so on to the third, or any greater number of groups of magnets, and thus the motion is continued in the same direction, until any required length of stroke is obtained.

As the philosophy of common things is now so much talked of, I hope this familiar illustration will be excused, and the three principal improvements effected by Mr. Allan be made apparent. That is the direct action of the magnet upon the body attracted, that action only passing through the most powerful range of the magnetic influence, and thus economising battery power, the motion being continued in the same direction, through any given number of groups of magnets, until it is made to pass over a sufficient space to be mechanically useful.

I am, &c.,

ALEXANDER DOULL.

Proceedings of Institutions.

Chatham.—The twenty-first annual report of the Committee of the Chatham, Rochester, Strood, and Brompton Mechanics' Institution states that while on former occasions they have been compelled to direct attention to its waning fortunes, they can now heartily congratulate the members upon the success of their efforts, and can point to a vigorous and thriving Institution, which has enlisted in its support the sympathy and good wishes of the inhabitants of the several towns, and which they believe has not even reached the zenith of its power and influence, but which is destined in their opinion steadily, yet certainly, to advance. The past year has indeed been a most important one in the history of the Institution; its most pressing want, that of a suitable public lecture hall, having been supplied by private enterprise. From the time of the removal of the Institution to the premises at present occupied, its progress has been a very marked one,—the number of members has been nearly doubled, being in the first quarter 402, whilst in the last quarter the number was 670. The income has increased proportionably, and the Committee have consequently been enabled to provide a class of lectures and entertainments vastly superior to those hitherto given. The Committee take the opportunity of expressing the deep gratitude they feel to their distinguished president, Charles Dickens, for the invaluable service he has recently rendered to the Institution: not only has he placed at their service the influence of a name, "familiar as household words" to all true lovers of English Literature, but he has also, in addition, given a public reading for the benefit of the Institution, the proceeds of which, amounting to nearly one hundred pounds, the Committee have resolved to devote to the improvement of a long-neglected appliance of the Institution, by investing the amount, after the bookcases have been paid for, in the purchase of a large number of valuable and standard works, to be added to the existing library. The Committee feel that they shall be acting in accordance with the wishes of the members, and at the same time perpetuating, in the most enduring manner, the remembrance of the deep obligations they are under to their president. The Committee, at the same time, gratefully acknowledge the receipt of valuable presents of books from Mr. R. Winch, jun., Mr. Jas. Austin, Mr. Tidyman, and J. Drummond, Esq.

Dartmouth.—The committee of the Literary Institution, in presenting their report of its proceedings during the past session, state that they do so with feelings of unmixed satisfaction. In establishing a society of this kind, the second year is rightly considered the time of trial, and when there appears no falling off in the number of members, but, on the contrary, a marked increase, whilst that warm interest which was evinced by the town generally at the outset, is still continued, it may safely be concluded that the Institution has acquired sufficient strength to warrant the most sanguine anticipations of its permanence. A large increase has taken place in the number of subscribers, the number last year being 288, and in the present year 275. Many volumes have been added to the library, both by donation and purchase—and the number of periodicals and papers in the reading room has been considerably extended. At the same time the best attention of the committee has been given, not only to the economical expenditure of the funds, but also to the character and utility of the works introduced. Classes also have been formed, which the committee hope will yet receive fuller development, as they feel satisfied that the institution of classes constitutes one of the most useful spheres of operation in societies of this description; the attendance also on the lectures has been most satisfactory, showing an average of 165 persons at each lecture. The numerical increase has been chiefly amongst the ordinary and quarterly subscribers, for whose use, more especially, the reading room and library were required. The committee, taking into consideration that many persons join the Institution with the sole object of attending the lectures, have thought it necessary, in some cases, to avail themselves of the services of lecturers from a distance, men of known talent, who are in the habit of addressing large audiences. It is, however, a matter of regret that on all these occasions

the expenses of the evening have very considerably exceeded the receipts. The committee propose during the ensuing session to engage the services of such men as Mr. Pengelly, of Torquay, or Mr. Hearder, of Plymouth, to deliver consecutive lectures on popular subjects, esteeming such a course more advantageous and instructive than lectures on a variety of subjects. The very great success that has hitherto attended the Institution has however its difficulties; the society has, in fact, outgrown its present accommodation, and it is proposed to raise by subscription a sufficient fund to erect a building capable of affording the necessary lecture and reading rooms. The French class has been in operation since November last, under the supervision of Mr. St. Dalmas, and at present numbers sufficient members to render it almost self-supporting, so that it requires but little aid from the funds of the Institution. A class for the study of natural history in connection with the microscope is forming, and only requires a small contribution for incidental expenses from persons inclined to join, to commence operations forthwith. Through the kindness of some friends, a handsome microscope was twelve months since placed at the disposal of this class. An addition of 110 volumes has been made to the library; 26 of these were presented by Mr. Kensington, to whom the thanks of the society are due for his kindness on this as well as on many other occasions. Mr. Windeatt and the president have also been contributors of books. The issue of books for the past six months has been 2000.

MEETINGS FOR THE ENSUING WEEK.

MON.......Entomological, 8.
FRI. ....Astronomical, 8.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 22nd June, 1858.
129. Bills—Confirmation of Executors, &c. (amended).
149. ——— Public Health (amended).

Delivered on 23rd June, 1858.
277 (1). Prideaux's Furnace-Valve Door—Return.
328. Contracts (Public Departments)—2nd Report from Committee.
115. Bills—Piers and Harbours.
141. ——— Wills of British Subjects Abroad (No. 2).
146. ——— Smoke Nuisance Abatement (Metropolis).
151. ——— Chief Justice of Bombay.

Delivered on 24th June, 1858.
339. Brewers, &c.—Account.
350. London Corporation (Receipts and Expenditure)—Return.
314. Bed of the Sea, &c.—Return.
150. Bills—Vaccination (Ireland) (amended).
152. ——— Medical Practitioners (amended).

Delivered on 25th June, 1858.
68 (5). Trade and Navigation Accounts (31st May, 1858).
332. Ballindine National Schools—Correspondence.
333. Belfast Constabulary—Copy of Report.
153. Bills—Sale of Grain, &c.
143. ——— Four Courts (Dublin) Extension.

Delivered on 26th and 28th June, 1858.
31. Property Tax and Population, &c.—Return (a corrected Copy).
351. Receipt and Draft Stamps—Return.
359. Navy—Abstract of Returns.
326. Colonisation and Settlement (India)—2nd Report from Committee.
156. Bills—Letters of Credit.
55. ——— County, &c., Property Conveyance.
158. ——— Probates and Letters of Administration Act Amendment.
159. ——— Divorce and Matrimonial Causes Act Amendment.
160. ——— Herring Fisheries (Scotland).
161. ——— New General Post-office (Edinburgh) (as amended by the Select Committee).

Delivered on 29th June, 1858.
354. East India (Deccan)—Return.
349. Sasines (Scotland)—Copies of Reports.
361. Aldershot Hospital—Copy of Report.
362. Accidents on Railways—Report from Committee.
344. Harbours of Refuge—Report from Committee.
118. Local Acts (36. Sunderland Dock Bill, No. 2)—Admiralty Report.
157. Bill—Clerk of Petty Sessions (Ireland) (amended).
The "Cagliari"—Further Correspondence.

Delivered on 30th June, 1858.
336. Metropolitan Board of Works—Returns.
346. Army, &c. (Receipt and Expenditure 1856-7)—Account.
162. Bills—Wills and Domicile of British Subjects Abroad, &c.
163. ——— Copyhold Acts Amendment (amended).
164. ——— Pauper Lunatics.
154. ——— Bankruptcy and Insolvency.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June* 25, 1858.]

Dated 7th May, 1858.
1022. W. Duff and J. Gilchrist, Liverpool—Imp. in apparatus for measuring water and other fluids, also capable of being used as a motive power.

Dated 21st May, 1858.
1138. W. Clark, 53, Chancery-lane—Imp. in the processes of treatment of peat, and of the hydro-carburets it contains, and in the apparatus for the same. (A com.)

Dated 25th May, 1858.
1168. P. Griffiths, Manchester-road, Burnley, Lancashire—Imp. in manufacturing bushes for fixing drums on shafts, and other similar purposes.

Dated 26th May, 1858.
1178. J. Luis, 1B, Welbeck-street, Cavendish-square—An apparatus for cutting square-headed corks, and for corking bottles with the same. (A com.)

Dated 27th May, 1858.
1192. W. Clark, 53, Chancery-lane—Imp. in preserving butter. (A com.)

Dated 29th May, 1858.
1208. J. Shuttleworth, Stamp End Works, Lincoln—Imp. in portable and other steam-engine boilers.
1210. W. Hodgson and H. Hodgson, Thornton-road, Bradford—Imp. in machinery or apparatus for preparing and spinning, or producing motley yarns from rovings of unequal thicknesses of wood or other fibrous substances.
1212. S. Rockett and J. J. Reynolds, Strand—Imp. in the manufacture of umbrellas and parasols.

Dated 31st May, 1858.
1220. J. B. Thornder, Halifax—Imp. in carriages for children, commonly called "perambulators," which improvements are also applicable to invalid and other carriages.
1222. G. K. Snow, Watertown, Massachusetts, U.S.—A new and useful machine for affixing postage stamps to letters.
1224. H. Jaeger, Paris—Imp. in dyeing wool. (A com.)
1226. J. Austin and J. Armstrong, Wellington, Salop—An imp. or imps. in the manufacture of coke.

Dated 1st June, 1858.
1228. A. Barchou, 22, Cranbourn-street, Leicester-square—A heel for boots and shoes.
1230. A. G. Grant, New York—A method of preparing paper in order to render it waterproof, and adapted for the reception of photographic pictures.
1232. R. W. Chandler, Bow, and T. Oliver, Hatfield, Hertfordshire—Imp. in agricultural apparatuses for ploughing and otherwise operating upon land.

Dated 2nd June, 1858.
1234. F. J. Candy, Haslemere, Surrey—Imp. in machinery for the manufacture of fishing and other nets.
1236. J. Luis, 1B, Welbeck-street, Cavendish-square—A new farming implement, called the gleaner. (A com.)
1238. D. Service, Barrhead, Renfrew, N.B.—Imp. in apparatus for producing printing surfaces.
1240. H. Brown, B. Hodgson, and J. Carter, Halifax—Imp. in machinery for introducing and withdrawing wires when weaving.
1242. R. Roberts and W. Shaw, Heaton Norris, Lancashire—Certain imp. in looms for weaving.

Dated 3rd June, 1858.
1244. J. Meiklejon, Dalkeith, N.B.—Imp. in boilers for heating water, and in valves for controlling and regulating the flow or passage of the same.
1245. R. Owen, Manchester—Imp. in water-closets, night commodes, or similar conveniences, and also in disinfecting processes.
1246. W. Clayton and J. Goodfellow, Blackburn—A certain imp. in pistons for pumps.
1247. J. Bethell, 8, Parliament-street, Westminster—Imp. in the manufacture of alum.
1249. A. V. Newton, 66, Chancery-lane—An improved manufacture of woven fabric, applicable chiefly where strength and duration are required. (A com.)
1250. G. Dalton, Lymington—Imp. in furnaces for smelting the ores of iron and other minerals.
1251. J. Mitchell, Dunning's-alley, Bishopsgate-street Without—Imp. in purifying paraffine.
1252. R. Owen, Rotherham, Yorkshire—Imp. in the manufacture of railway wheel tyres, and in machinery employed therein.
1253. H. Edwards, Dalston—An improved pipe stem or tube.
1254. T. Wilson, Bradmore-house, Chiswick—Imp. in the construction of mangles.
1255. J. Baron Von Liebig, Munich—Imp. in protecting the silvered surface of mirrors and other articles of glass.

Dated 4th June, 1858.

1256. W. Hargreaves and E. Haley, Bradford—Imp. in machinery or apparatus for preparing and combing wool, hair, silk, cotton, flax, and other fibrous substances.

1257. E. M. Stoehr, Manchester—Certain imp. in looms for weaving. (A com.)

1258. J. F. Dickson, 6, Russell-street, Litchurch, near Derby—Imp. in the permanent way of railways.

1259. V. Merighi, Paris—Means for preventing dust on rail-roads.

1260. V. Merighi, Paris—Means for impeding and exhausting fires on railway trains.

1261. T. Crick and J. T. Crick, Leicester—Imp. in the manufacture of boots, shoes, and slippers.

1262. R. Quin, 5, Rodney-street, Pentonville—Imp. in ordnance and fire-arms.

1263. R. A. Brooman, 166, Fleet-street—Imp. in preparing the fibrous portions of certain textile plants, and the employment thereof when prepared either along or in combination with articles already in use for the purposes of stuffing. (A com.)

Dated 5th June, 1858.

1265. J. Banks, Liverpool—An improved reaping machine.

1266. M. Page, Valdoie, near Belfort, France—A steam or power kneading apparatus.

1267. H. Carter, Manchester—Imp. in gas burners.

1268. C. Hancock, West Ham Gutta Percha Company, West-street, Smithfield—Imp. in the manufacture of electric telegraph cables.

1269. E. Cooke and G. Dickinson, Smethwick, Staffordshire—Imp. in the manufacture of metallic and other bedsteads, and other articles for sitting, lying, and reclining upon.

1270. R. Orr, Glasgow—Improved apparatus to be applied to various machines used in the manufacture of yarn or thread.

1271. A. Manbré, Rathbone-place—An improved method of preparing malt and other grain, and in preparing the saccharine matter therefrom, whether for the purposes of brewing, distilling, or otherwise.

1272. F. H. Whiteman, 28, Essex-street, Islington—Rendering paper hangings, for decorating the interior of houses, capable of being washed by soap and water without detriment to the colours thereof.

1273. W. Porter, 9, Lansdown-villas, Brompton—Imp. in artillery ordnance, and some other descriptions of fire-arms.

1275. G. Hadfield, Carlisle—Imp. in the protection of carboys or other vessels and packages.

Dated 7th June, 1858.

1276. E. Scotson, Clayton, and H. Charley, Grimshaw-street Foundry, Preston, Lancashire—Imp. in machinery connected with traction and other engines, and in endless railways, to be used therewith.

1277. J. Ferrabee, Thrupp, near Stroud—Imp. in machinery for cutting, collecting, and spreading grass, and for sweeping.

1278. J. J. Rowley, Rawthorne, near Chesterfield—Imp. in apparatus for applying lime, soot, and other matters to turnips and other crops, and manure to land.

1279. J. Boullenger, and L. J. Martin, Paris—An apparatus serving to the decomposing neutral fatty substances into fatty or oily acid and glycerine.

1280. J. M. Dunlop, Manchester—Imp. in apparatus for sizing fibrous materials.

1281. H. Wimball, Aldermaston, Berkshire—Imp. in machinery or apparatus for destroying the turnip fly and other destructive insects on growing crops.

1282. E. Vigers, Paddington—Imp. in the manufacture of bricks and other articles moulded or formed from clays.

1283. J. B. A. Lombard and X. T. Esquiron, Paris—A new or improved method of obtaining saccharine substances from cereal and vegetable matters, and applying the products obtained to various useful purposes.

1284. R. Hicks, Chatham-place—The manufacture of a composition or compositions to be employed as black lead.

Dated 8th June, 1858.

1285. J. M. Dunlop, Manchester—Imp. in bowls or rollers used in machines for printing fibrous materials.

1287. I. Ketchum, 59, Canning-street, Liverpool—An improved self-acting perforated baster.

1289. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of copper pipes and tubes. (A com.)

1291. A. Robertson, Sheffield—Imp. in stoves or fire-grates.

1293. D. Irons, 6, Cornwall-terrace, Creek-road, Deptford—Imp. in the mariners' compass

1295. A. Rigg, senr., and A. Rigg, jun., Chester—Imp. in apparatus for tipping or upsetting coals, minerals, or other substances, and in brake machinery.

Dated 9th June, 1858.

1297. F. A. Gatty, Accrington—Imp. in dyeing cotton and other fibrous materials and fabrics.

1299. S. Lees, Salford—Imp. in the manufacture of tan or tanning, and in tanning hides to make leather.

1301. E. C. Grimshaw, Denton, Lancashire—Imp. in furnaces and steam boilers.

1303. C. F. Vasserot, 45, Essex-street, Strand—An apparatus for measuring and registering the flow of liquids. (A com.)

1305. P. Dumont, Southwark-square, Borough—Improved implements for distributing or applying powder.

1307. H. Rollinson, Stepney—An artificial fuel.

1309. J. Roberts, Upnor, Kent—An improved construction of reflector or cover for gas burners.

1311. J. Roberts, Upnor, Kent—An improved construction of stove.

Dated 10th June, 1858.

1313. T. W. Mellor and W. Jamieson, Ashton-under-Lyne—Certain imp. in looms for weaving figured fabrics.

1315. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved thrashing machine. (A com.)

1317. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved nose-bag for giving horses their oats, &c. (A com.)

1319. J. S. Crosland, Ashton-under-Lyne—Certain imp. in steam engines.

1321. G. Hall, Saint John's, Worcester—Certain imp. in cartridges.

1323. W. Wilkinson, Bayswater—Certain new textile and other combined fabrics and means of ornamenting fabrics and skins.

Dated 11th June, 1858.

1325. J. Gemmell, Belfast—Imp. in the manufacture of starch.

1327. L. A. Bigelow, 133, High Holborn—A new and improved machine for sweeping carpeted and other floors. (A com.)

1329. W. E. Newton, 66, Chancery-lane—Improved apparatus for supplying boilers with water. (A com.)

1331. L. F. Lenière, Canderan, France—Imp. in treating hemp or tow for the caulking of ships and vessels, parts of which improvements are applicable to washing and cleansing textile articles or fabrics impregnated with greasy or oily matters, and in the apparatus connected therewith.

Dated 12th June, 1858.

1335. J. Hall, Derby—An imp. in the slide valves of steam engines.

1337. A. Gibson, J. Pollock, and J. Martin, Stratford—Imp. in the construction of steam engine boilers and furnaces for effecting the prevention of smoke.

1339. A. V. Newton, 66, Chancery-lane—Improved machinery for cutting veneers. (A com.)

Dated 14th June, 1858.

1341. J. H. Young, 66, Great College-street, Camden-town—Imp. in setting up (composing) and distributing types.

1343. H. N. S. Shrapnel, Medway Manor House, Bradford—An imp. in preparing iron and other metals, or mixtures of metals, for and in casting the same in moulds.

1345. J. Hetherington, Store-street Mills, Manchester—Imp. in guides or clearers used in machines for winding, reeling, and clearing threads of cotton, silk, and other fibrous materials.

1347. J. C. Henderson, Albany, U.S.—Imp. in stoves.

Dated 15th June, 1857.

1349. L. C. S. Masson and F. de la Morinière, Paris—Imp. in the manufacture of woven fabrics with coloured patterns.

1351. G. Adshead, Staley New Mills, Staley-bridge, Chester—Imp. in steam boilers.

1353. W. P. Wilkins, Ipswich—Imp. in the arrangements and construction of refrigerating apparatus.

1355. H. S. Warner, Trinidad—Imp. in the manufacture of decolourizing and purifying charcoal.

1357. J. Rubery and T. Warwick, Birmingham—Imp. in machinery and tools for making certain portions of umbrellas and parasols and lingoes.

Dated 16th June, 1858.

1359. G. T. Bousfield, Loughborough-park, Brixton—Imp. in apparatus to be used in the construction of small boats. (A com.)

1361. C. W. Lancaster, New Bond-street—An instrument or apparatus for charging cartridges for breech-loading arms.

1363. J. J. Cregeen, Plough-road, Rotherhithe—Imp. in the treatment of India and China grass, pine apple, hemp, flax, and other similar fibrous materials, and in the machinery or apparatus employed therein.

1365. J. C. Hill, Wildon Iron Works, near Abergavenny, Monmouthshire—Improved apparatus for ascertaining and indicating the height of water in steam boilers.

1367. G. Davies, 1, Serle-street, Lincoln's-inn—An improved equilibrium slide valve for steam engines. (A com.)

Invention with Complete Specification Filed.

1360. B. Atwater, Connecticut, U.S.—An improved sewing machine. —16th June, 1858.

WEEKLY LIST OF PATENTS SEALED.

June 25th.

3168. A. Bruce.
3169. J. Barling.
3178. T. Spencer.
3189. J. D. Morrison.
3198. G. Wilson.
6. J. W. Clare.
8. R. Harvey.
12. F. Walton.
40. T. Rowell.
78. C. A. de Laire de la Brosse.
83. E. Wilson.
176. P. Ashcroft.
250. R. Aytoun.
450. R. S. Bartleet.
506. A. V. Newton.
633. W. Richards.
748. W. Nimmo.
769. Hon. W. Talbot.
900. W. Foster.
901. A. Jenkin.
910. J. Horton.
937. W. E. Newton.
972. J. H. Johnson.
992. W. E. Newton.

June 25th.

3187. F. Palling.
3188. T. Booth.
3190. J. O'Neill.
3192. J. Clinton.
3195. H. Hanson.
3. L. J. A. Brun.
7. J. H. Johnson.
71. R. J. Badge.
977. W. Spence.

Patents on which the Stamp Duty of £50 has been Paid.

June 21st.

1431. W. Teall.
1439. H. N. Penrice.

June 22nd.

1480. A. E. L. Bellford.

June 25th.

1456. F. Leiss and C. Schneider.
1458. M. Poole.
1483. E. J. Hughes.

Journal of the Society of Arts.

FRIDAY, JULY 9, 1858.

MEETING OF COUNCIL.

Wednesday, July 7th, 1858.

The Council held their first meeting this day since their election. C. Wentworth Dilke, Esq., Vice-president, was elected Chairman for the current year.

PREMIUM LIST.

The Council have determined to issue a new Premium List for the ensuing Session. Members are requested to forward to the Secretary any suggestions relative to desiderata in Arts, Manufactures, and Commerce.

SMALL PARCELS POST.

The Committee appointed by the Council for considering the expediency of establishing a General Post for Small Parcels, have made the following

Report.

By the law, as it now stands, every letter is defined to be a parcel, and every parcel transmitted by the post is defined to be a letter. The Treasury is restrained from charging more for letters than the rates particularised in the Act, but is allowed an unlimited discretion as to the imposition of any lower rates which may appear to it to be required by the public convenience and interests in the revenue. The whole principle of a parcel postage, and the rates at which it may be best conducted for the public advantage, are by the legislature thus beneficially committed to the executive government.

At this time, when, by the repeal of the newspaper stamp, a deficiency has been occasioned in one branch of revenue, the Committee hope to show that, by the improvement of the parcel postage, much may be done eventually to make good that deficiency, whilst great service may be rendered to the public and to the postal establishment itself, and even to the chief mail carriers and railway undertakings.

The conveyance of small parcels by the post is not new to it in principle—at all events to the metropolitan district. In 1748, the administration of the penny post was spoken of by De Foe as admirable for the quickness of the transmission of parcels as well as letters from four to eight times a day: "Nor are you," he says, "tied up to a single piece of paper, as in the General Post-office, but any packet under a pound weight goes at the same price." In several of the continental posts a small parcel post is connected with the letter post.

At present, the small parcel post, strictly so called, is, in this country, in a condition of over-taxation worse than that of the old letter post. Even the rate for books is so high as to be resorted to only in very special, and, comparatively to the general book circulation to the provinces, rare cases. The charge, for other things than books or letters, of 2d. per ounce, or 2s. 8d. per ℔., is prohibitory, except for light articles, or articles of very small bulk and very high value, or for small matters the rapid transmission of which is extremely important. The present charge of 2s. 8d. a ℔. interposes, in a large proportion of cases, insurmountable barriers to the collection and transmission of paint-boxes, cases of instruments, small models, small objects of art, such as those with which the Society of Arts is conversant. In respect to the labouring classes especially, the present rate of charge offers the like obstructions to the transmission and interchange of small things and articles which are of high social value, to those which prevailed under the old postage system, to trading and family correspondence. A son, in place in London, sends to his mother, by postage-stamps or money-orders, a portion of his wages; she, in return, might send to him a pair of knitted stockings, or some piece of her own work, no larger than a book. A mother may now send to her son in place or in the army, by the present regulations, a quarter of a pound of printed matter for a penny,—she would send him a pair of socks or a "comforter," of no greater weight or bulk, but that the charge at the rate of 2s. 8d. for the pound is prohibitory. Naturalists would transmit specimens, horticulturists would exchange seed, farmers would send samples of corn and cereal produce as often as they now send letters,—where only very small and unsafe samples are now given, full and satisfactory samples would be sent;—tradesmen would transmit small articles to special customers in remote districts, but for the over-taxation, or the extreme overcharge—for the service which ought to be rendered to the public by the public agency.

The necessary expense of the separate transmission of small articles to distant places by any existing private means also in a great majority of cases amounts to a prohibition. In those cases where no porterage is required in sending the article to the coach-office, or to the railway-station, or from the terminus or the country coach-office to its destination, the transmission of small articles may be easy, and the charges moderate; but when there are one, two, or three miles of porterage at one or both ends the expense frequently exceeds the value of the article which would be sent if the charge were moderate.

It rarely happens that any fault is to be found with innkeepers in respect to their charges for parcel delivery, for in all those cases where the receivers may live at country houses two or three miles from the station or the inn, a porter must be employed for the delivery of that one parcel alone, and the quarter or half day of the porter's time and labour must be paid for—and payment must be made, moreover, for the innkeeper's trouble. But the post has already an agency, established and paid for, which may be called a general porterage, for the delivery of letters, available for rendering separate porterage, to the inns or the stations, unnecessary over a large part of the country. The post cart which from Kensington and Bayswater collects the letter-bags to be conveyed to St. Martin's-le-Grand, may, without injurious addition to the weights, carry small articles, for each of which the sender must now, if the direction be provincial, get a porter to carry it to the inn or the station, often at an opposite side of the metropolis. The postman who goes out from the country town a mile or two, to a house or village with a handful of letters, might, without inconvenient addition to his labour, carry a bag of small parcels. It will be found, therefore, in such cases, that at a payment of 4d. for a parcel of a ℔. weight the post may do at a profit that which the innkeeper could not do by the payment of the messenger for the one parcel of a shilling or two shillings,—an expense of labour which it is not worth while in the majority of cases to incur, and which is not incurred.

The instances given are of cases of transmission over one line of main carriage from which separate porterage at either end is requisite. But when it is required to send any parcel over cross countries, or very long dis-

tances, the changes of carriers and the variations of charges which it is very difficult to ascertain, augment the obstacles to transmission at every change. These obstacles may be illustrated by supposing that a naturalist engaged on the coast at one end of the kingdom wishes to transmit a specimen or a small parcel from the Land's End to John o'Groats or May, the transmission being for the greater part of the distance over large trunk lines of railway, and the private means of conveyance in the highest state of organisation attained, or at present deemed attainable by private means. If, from the great amount of the charge, or from any loss or injury occurring in the transmission, there were occasion to investigate the changes of conveyance, with much labour, and by the aid of directories, they might be found to be as follows:—A small parcel, to be transmitted from the Land's End to May, near Thurso, must be conveyed, 1st, by one foot messenger from the Land's End to St. Buryan; 2, by another foot messenger from St. Buryan to Penzance; 3, from Penzance to Truro by mail cart; 4, from Truro to Plymouth by mail coach; 5, from Plymouth to Exeter by South Devon Railway; 6, from Exeter to Bristol by the Bristol and Exeter Railway; 7. from Bristol to Tamworth by the Midland Railway; 8, from Tamworth to Preston by the London and North Western Railway; 9, from Preston to Carlisle by the Lancaster and Carlisle Railway; 10, from Carlisle to Greenhill by the Caledonian Railway; 11, from Greenhill to Perth by the South Central Railway; 12, from Perth to Aberdeen by the Scottish North-Eastern Railway; 13, from Aberdeen to Keith by the Great North of Scotland Railway; 14, from Keith to Elgin by coach; 15, from Elgin to Inverness by the Inverness and Aberdeen Junction Railway; 16, from Inverness to the South side of the Meikle Terry, near Tuin, by mail; 17, from the South to the North side of Terry by a boat; 18, from Terry to Thurso by mail coach; 19, from Thurso to May by messenger.

Take the case of the need of transmission of a small parcel from the Land's-end to another extremity of the United Kingdom, as to Valencia, in Ireland. It must be conveyed by the seven distinct changes of carriers to Tamworth, and then it must, 8, from Tamworth to Chester by the London and North Western Railway; 9, from Chester to Holyhead by the Chester and Holyhead Railway; 10, from Holyhead to Kingston by the mail packet; 11, from Kingstown to Dublin by the Kingstown and Dublin Railway; 12, from Dublin to Mallow by the Great Southern and Western Railway; 13, from Mallow to Killarney by the mail car; 14, from Killarney to Cahirciveen by another mail car; and, 15, from Cahirciveen to Valencia by foot messenger.

A parcel from May, near Thurso, for Valencia, must be conveyed by eleven different changes or different carriers to Preston; and from Preston to Chester it would be conveyed by the London and North Western Railway, and from Chester to Valencia by the several changes above mentioned, making in all 19 changes. The members of the Chambers of Commerce of such places as Manchester, Liverpool, Glasgow, Leeds, Bradford, or Birmingham, by drawing lines from their own centres to the remote places of demand, may estimate for themselves the obstacles created by the changes of carriers to the transmission of small parcels. Usually each separate carrier has a separate rate of charges. One of the larger railways has upwards of four hundred different prices, charged, not upon any common scale of weight as for a service, but upon estimates of the necessities of the senders and what, from the nature of the goods, they can be made to pay, as to a monopoly for transmission. The railways are often hostile and not always very accommodating towards each other, in respect to the transmission of each others goods, any more than each others passengers. The difficulty in ascertaining any cause of injury or delay which may occur in the transmission of parcels, is as the number of separate carriers. The larger portion of the parcel traffic will, of course, be within the shorter distances, but in repect to the smaller parcels, the greater and insuperable obstacles to any private conveyance, it may be expected, will be in the larger distances. On the present occasion no question is intended to be raised as to the effect of the unharmonized machinery of upwards of 90 different and conflicting railway companies, for conveyance upon the larger parcels or goods traffic. In respect to smaller parcels, there is little or no experience of the effects of the multiform charges upon any attempted transmissions to the longer distances, the general effect being that the charges for them are simply prohibitory. From thence they are only transmitted at very long intervals when a relation or a friend is travelling to town or to the place of destination, and will charge himself with them as part of his baggage.

The transmission of the small parcels of the description in question, by private conveyance, are so few and exceptional that they may be set aside as of no account, and it may be assumed that the great bulk of them are lost to the railway companies;—those that are sent being lost for separate transmission by being comprehended in the passengers' luggage; and those which are not sent being lost by the operation of the necessarily high prohibitory charge;—any considerable traffic of the kind being, in fact, out of their reach or means of sufficiently moderate charges, by the unavoidable necessary expense of separate porterage.

It is submitted that to meet the cases of these smaller parcels, the public postage service should be further utilized, and that in doing so the public revenue may be improved, with gain rather than loss to the railways. The service needed could not be rendered by any separate establishment or by any other means, so cheaply as by the post, in the great class of cases indicated. The establishment charges of the postal agency being already more than paid for by the penny postage upon letters; if we could also have a second distinct and universal system of porterage for small articles, the establishment requisite for that separate system must be maintained by an additional payment; and why should the public be put to the additional expense and trouble of an irresponsible and uncertain private agency, when there is a public and responsible agency already established which is available for the purpose? In a great number of cases, as already stated, the unavoidable expense of the second agency must, under any circumstances, be prohibitory for all but parcels of a great weight or of a high value, or very special character to make it worth while to pay for it as for an extraordinary service. No doubt, by the measure proposed, some private conveyance may be slightly interfered with, as coachmen and private carriers were interfered with by the institution of the Post itself—as bankers were interfered with in having, here and there, one of the larger remittances which they might have been charged with sent by post, amidst the vast multitude of smaller remittances which they could never have sent at the present rates, and which would never have been sent at all but for the new and beneficent service by cheap money-orders. Certain stationers petitioned and agitated against the new postage system itself, as they alleged it would interfere with their sale of envelopes and stationery. On such sordid views and ignorant cupidity, the petitioners would have deprived the community of the social and commercial advantages of a six-fold inter-communication, which apart from the new packet system has replaced the revenue. By that change of system the sale of envelopes has, however, been immensely augmented, no doubt, to the profit of the objectors. To maintain the present prohibitory rates on small parcels, for the sake of any private carriers' interest, is to retain unavoidably high charges for the separate porterage, amounting to a prohibitory tax, at a vast expense of public inconvenience, for the small gain (if any) of a few private persons. Indeed, under such an extension of service as that proposed, the carriage on the trunk lines and the

railway profit on such carriage would probably be much increased. Mr. Rowland Hill's enlightened principle of saving the public the trouble of inquiring for the right charge, and the trouble of adjustment, by one uniform rate of postage, is applicable to the conveyance of small articles, in respect to which, at present—the public is, in addition to the heavy expense, subjected to the trouble of inquiring, or searching directories, for the proper place of dispatch, and also of looking out for, what is commonly not easily found,—the means and time of certain delivery.

When the destination of any small parcel is in the country or cross roads, the delivery is grievously uncertain, as well as expensive. Those who have had experience of the privilege of franking from large public departments, will have had repeated evidence of the common necessities in respect to small parcels, in the attempts to abuse the privilege for the purpose of getting them conveyed with certainty. At the present time the postal establishment is subjected to a war of evasion, for the conveyance of small parcels as books, of which instances might be given.

The charge for sending the larger parcels by the old mail-coaches was from 12s. to 14s. per cwt. per hundred miles. The average weight of a passenger is under 165 lbs. Assuming the railway charge for carrying first-class passengers were a general charge for the carriage of parcels, it would be at the rate of $1\frac{1}{2}$d. per lb. per 100 miles.

Some time ago the estimated distance of the transmission of letters in England was about seventy miles each, exclusive of those sent by the district posts. An average of 100 miles for each small parcel, *inclusive* of those transmitted by the district posts and delivered within the districts, would probably be a very wide one.

It has been avowed on good authority that locomotive expenses on railways do not, on an average, exceed $9\frac{1}{2}$d. per mile, and that "the cost of running a train may be assumed to be, in most cases, about 15d. per mile." But it is observed in a paper by Mr. Edward Page, Inspector General of Mails, that "these rates, while they no doubt include in some cases special elements of expense not covered by the average of 15d. per mile, are independent of the receipts obtained from passengers, parcels, and, in some cases, from goods, earnings which, added to the Post-office allowance have, in many instances, rendered the mail train one of the most profitable trains on the line," instead of being, as is sometimes supposed, a sacrifice and a grievance. Indeed it appears on impartial examination, that although the speed of the transmission of letters has been augmented by railway, the cost of the conveyance appears to be augmented against the public, the present rates being, in some instances, at from 2s. to 4s. per mile, or at a profit of from 60 to 260 per cent. on the actual cost, that is to say, supposing the train carried nothing but the mail. The contrast will be seen in a Table, from the Postmaster-General's second Report.

—	Mails conveyed by Railways.				Mails Conveyed by Coaches, &c.			
	Number of Miles per Week Day	Average Charge per Mile.	Maximum.	Minimum.	Number of Miles per Week Day.	Average Charge per Mile.	Maximum.	Minimum.
		s. d.	s. d.	d.		d.	s. d.	d.
England	21,069	0 $9\frac{1}{4}$	4 10	$\frac{1}{4}$	19,371	$2\frac{1}{4}$	0 $10\frac{1}{4}$	Exemption from Tolls.
Ireland	2,503	1 $5\frac{1}{2}$	4 6	$\frac{1}{4}$	7,293*	2	0 8	$\frac{1}{2}$
Scotland	3,537	0 $8\frac{3}{4}$	3 2	$\frac{3}{4}$	5,003	$2\frac{1}{2}$	0 $6\frac{1}{4}$	$\frac{1}{4}$
United Kingdom	27,109	0 10	4 10	$\frac{1}{4}$	31,667	$2\frac{1}{4}$	0 $10\frac{1}{4}$	Exemption from Tolls.

* The corresponding number of miles in the Report for 1854, was, by an error, much overstated,

It appears, by the last report of the Postmaster-General of the United States, that the average cost per mile there (where coal and fuel is much dearer than in England) paid for the postal use of the railway, is only $5\frac{1}{6}$, being little more than half the payment in this country.

The working expense of railway carriage of goods in bulk is known to be about three-eighths of 1d. per ton per mile—assuming that interest on capital is already paid by passenger or other traffic—so that a halfpenny per ton per mile, for carriage in bulk and distances of more than fifty miles—pays for steam-power, carriages, locomotion, and yields a profit of twenty-five per cent. on the work.* One halfpenny per mile is charged at the "clearing house" for each additional carriage, but it is now ascertained that supposing "the steam is up," three halfpence per mile pays for the additional steam power, for the wear and tear of the carriage, for the wear and tear of the road, for each additional carriage put on, and for its additional load, whether of goods or of passengers. But, taking even the rates of charges by mail coach, and the highest rates of charge for railway conveyance at $1\frac{1}{2}$d. per lb. per 100 miles—taking a single parcel, if to the $1\frac{1}{2}$d. for the main carriage in bulk, with others, we add a farthing—or, if that be too little—a halfpenny for the collection of the parcel from the letter receiving-house; and a halfpenny to the letter-carrier for its delivery from the place of arrival to the place to which it is directed, we have $2\frac{1}{2}$d. per lb. for the cost of the labour on the prime cost of the service required for the public. The exact sums would be matter of investigation. But, assuming the cost stated to be near the mark, the public might be served at the rate adopted, in respect to printed matter, of 1d. for every four ounces, or 4d. per lb. for the conveyance of small parcels, with remunerative charges to the postage-staff and the letter carrier, which extra payment to the officers of the post for extra work is considered to be just and necessary, and consistent with a good profit to the revenue.

It is assumed that the business of conveyance should be left quite free and open, and that, for all the larger packages, where time and convenience served, the present conveyances would no doubt continue at the cheaper rate at which they now are carried on. There is at present much parcel delivery by companies and private carriers, at rates under 1d., and even of a halfpenny per lb. By the South Western Railway Company, parcels under 7 lbs. are carried upwards of 70 miles for 6d.; under 28lbs., 39 miles for 8d. If the public right to utilise their own establishments for their own purpose were admitted to be justly questionable, the proposed rate of charge will be a high protection-duty to the fair interests of all private carriers, for they may be confident that

* The following are illustrations of some goods charges of the Great Western and North Western—

Hogsheads .... Barrels .... Chicory root	From London to Birmingham. 21s. 8d. per Ton.
Lump Sugar .... Raisins .... Figs .... Coffee	27s. 6d. per Ton.
Tea	32s. 6d. ,,

3) 81.8
27.3
12
327
4

2240 lbs.) 1308 q. = $\frac{13}{22}$ q. per lb. for 108 miles, or $\frac{1}{4}$d. per lb. for 182 miles. A farthing per 182 miles—assuming that distance to be the average or mean for all packages sent—will be one farthing per lb.; and anything over one farthing per lb. paid to Railway companies by the Government Post-office will be so much gain to the companies.

the public will not pay 4d. per lb. where there is the option of getting the service performed at a rate of 1d. or a ½d.; neither will the public use the high-priced public postage, unless under strong and exceptional circumstances—that is to say, under those circumstances where the present charges are now, as a general rule, prohibitory. Indeed, on the present footing of the post, it is deemed an error, leading to much troublesome and unnecessary regulation, to assume a monopoly in the delivery of letters. Unless in very rare and exceptional cases, which on a large scale do not compensate even for the trouble of regulation, much less of the police to enforce prohibition, no private carrier can deliver so cheaply as the Post Office now delivers letters. The regulation which provided that there should be no writing in any book sent by post, imposing the trouble of opening every book sent, to save an occasional penny postage stamp, appears to the Committee to have been a regulation on the tradition of a dear post, and that the opening of parcels to prevent the transmission of matter in the nature of letters, would cost more than can be gained by it. There are, no doubt, people who will bestow a shilling's worth of labour to effect a penny saving, but the saving of labour in a busy community will be the general rule, and officers or the public ought not to be taxed with a pound's worth of trouble and labour of inspectors' for the prevention of such petty evasions.. If a package does contain a bill of parcels, or a note to be delivered with it to a person resident in the same house, or to a neighbour within a few doors off, why let it go—and do not put the sender to the trouble of a separate dispatch. Let the beginning and end of the actual need of service be the beginning and end of chargeability. The Post-office authorities may be sure that, if anything be required to be delivered half a mile away, their own delivery for a penny will be found to be the most certain, cheap, and speedy, and the interests of the revenue may be confidently left to the operations of the interests of classes, in the more certain and convenient public conveyance.

It is submitted, therefore, that whilst a merely weight parcel as well as book-postage, with such limitations as now exist against sending combustibles or other matters, dangerous or inconvenient, such as are now excepted by the postal regulations—might be made a means of improving the revenue and the postage system, it would confer, in the aggregate, great public conveniences, and be of collateral social advantage similar to that of the new money orders, as well as to the uniform and cheap post itself.

On the principle, then, that the General Post, having the largest established machinery for collection and distribution, and the establishment charges for that agency being already more than paid for, and, indeed, the former revenue being now replaced by the small letter post, the postal agency may be requested to perform other services at a profit—at rates which can only be performed by separate establishments at a loss.

Upon their own observation and practical experience, and reasoning upon general principles, the conclusions above stated were agreed upon, when it appeared that the principles in question had been developed very fully before the Committee of the House of Commons on the conveyance of Mails by Railways.

On examining the evidence, and the report of that Committee, they appear to be so important and conclusive in favour of the views and principles hereinbefore set forth, for the conveyance of all small parcels, as to require that some portions of the evidence should be cited at length. The *italics* and the remarks in brackets are inserted.

The Committee find that, in reference to book parcels, such services of the Post Office (as we assume should be rendered for the conveyance of all parcels whatsoever), are thus described in the evidence of Mr. Rowland Hill himself:—

" *Q.* What is the advantage which you think the public have with regard to the conveyance of books by post, instead of by other means of conveyance?—The principal advantage, I think, is, that the present system gives to the public the benefit of a very complete organisation for the distribution of book parcels [and all other parcels]; the organisation of the Post-office is exceedingly complete as compared with that of the railway companies for the same purpose.

" *Q.* In what particulars?—If a person residing in one part of the country should desire to send a book to another part, he would find very considerable difficulty in knowing how to proceed, if he were entirely dependent upon the railways. North of the Thames, I believe, there is a general organisation for the distribution of parcels, so that a parcel taken, for instance, to Euston-square, would be carried all the way, say, to Aberdeen, for one payment, the sum paid being divided among the several companies concerned, according to an arrangment existing among them; but I believe that that organisation does not extend to railways south of the Thames. It therefore follows that even the towns which are upon railways are not connected one with another for purposes of this kind; but the difficulty is even greater, if an attempt be made to send a book [a small parcel] otherwise than through the post from one village to another; for instance, suppose a person living at a village in the neighbourhood of Wells should desire to send a book [small parcel] to a friend living at some village in the neighbourhood of Inverness. The parcel would have to be carried first, by *a village carrier*, probably, to Wells; then by coach from Wells to the nearest railway station; then by railway to London; then by van through London to the Euston-square station; thence by railway to Aberdeen, from Aberdeen to Inverness by coach, and from Inverness to the village by the *village carrier* [and these carriers must now commonly be employed and their time paid for, for the carriage of the single parcel]. Seeing that the parcel would have to pass through so many hands, I have every reason to believe it would be quite impossible for the person sending it to ascertain beforehand what would be the total charge which he or his friend would be subject to; and in the event of the parcel being lost on the way, it would evidently be almost impossible for any effectual inquiry to be made as to who was in fault. On the other hand, if the book [or small parcel] be sent by the post, the person sending it has no trouble of inquiring as to the means of despatching it; he has merely to put it into the nearest post-office, pay upon it a moderate, fixed, and well-known rate of charge, and it reaches its destination without any further care on his part; and should it be lost or detained, he has no difficulty whatever in addressing his inquiry to the Post-office, with the view of ascertaining where the fault lies. I think the Committee will see that the Post-office organisation for the purpose of distributing book [or small] parcels is therefore incomparably superior to any organisation which exists among the railway companies.

" *Q.* If a parcel is despatched from England to Ireland, does the same postage carry it the whole way?—Yes; the uniform rate carries the parcel from any part of the United Kingdom to any other part; it would carry it even from the Channel Islands to the Shetland Islands."

Some of the larger railway companies having put forward the practice of carrying small parcels by the post as a ground for demanding a considerable rate for the conveyance of mails for the public, or more than the common rates to private individuals, the following replies were made to them, in behalf of the public, by the Post Office authorities:—

" In reply to your (*i.e.* the Companies') complaint that the Post-office has well-nigh monopolised the parcel traffic to which in your opinion railway companies had every

reason to look as a legitimate source of revenue, it is sufficient to say:—1st. That the statement is a great exaggeration, and that your calculations of such traffic are founded on very erroneous data. 2nd. That by far the larger number of the existing railways, your own inclusive, were commenced since the establishment of penny postage, the time at which the Post-office began to share in the traffic to which you refer. 3rd. That the railway companies have no exclusive right in the parcel traffic, and, indeed, should be the last to complain of that interference with existing modes of conveyance which they themselves (I am far from speaking in blame) have carried to an extent for which it would be difficult to find a precedent. And lastly, it might be shown that the distribution of small parcels by the Post-office with its undivided responsibility, and its wide organisation, uniting every town and every village one with another, and thus supplying facilities which the railways do not possess, so far from injuring the railway companies, yields them a beneficial traffic. Its advantage to the public at large can need no demonstration."—"I may mention," says Mr. Hill, "that with a view to this examination, I have made some inquiries of the publishers who use the book post extensively, and the information that I have obtained from them is to this effect, viz., that the large majority of the books sent through the post would not, but for the convenience afforded by the Post-office, be sent at all; and that the minority are not abstracted as small parcels which would otherwise be conveyed by the railway companies, but are taken from the large booksellers' parcels, such as are usually sent from the London publishers to the country booksellers. Now, as there can be no doubt that the Post-office pays the companies at a higher rate for the conveyance of the mails than that which the booksellers pay for their parcels, it would follow that, even if the whole of the books sent through the post were abstracted from the booksellers' parcels, the railway companies would still be gainers; but inasmuch as we not only pay a higher rate, but send a large number of books which otherwise would not be sent at all, it is manifest that the companies gain in two ways."

This reasoning is completely sustained by further evidence, and is at all points applicable, as previously stated, to the proposed improvement of the conveyance of small parcels, and illustrative of the views of this Committee.

Efforts were made by the railway directors on the Committee of the House of Commons, to show that the conveyance of small parcels by the post impeded the general letter conveyance, but these efforts failed. Mr. Hill was asked :—

Q. Have you any reason whatever to believe that the conveyance of such letters as may be called parcel letters interferes in any way with the due conveyance of ordinary letters and newspapers?—Not the slightest.

Mr. Hill further illustrates this subject :—

Q. "With respect to the conveyance and distribution of these small parcels, do you think that any organisation of railways, or otherwise, that could be established, could take the place of that organisation which already exists in the Post-office system, penetrating, as it does, to every quarter of the United Kingdom, and to every remote village and town?—One can hardly conceive the possibility of another organisation equally perfect. If the railway companies were to attempt it, they would incur enormous expenses; and it appears to me to be more to their interest to avail themselves of our organisation than to attempt to establish one to compete with it. I would mention also, if you please, with reference to this question of parcels, that in several parts of the Continent the heavier packets are actually charged at a lower rate; that I know to be the case in France. The charge for a letter not weighing more than seven grammes and a half, which is about equivalent to a quarter of an ounce, will be, on the 1st of July this year (when their law changes), 20 centimes, or 2d.; but for heavier packets they charge at the rate of 80 centimes, or 8d., for 100 grammes, which is equivalent to about three ounces and a third. Their rates, therefore, for heavy packets are less than one-third of the rate for letters, and there is no limit to the weight that may be sent at those rates.

Q. Do you recollect that Captain Huish, in his own case, gives rather a good illustration of the use of the Post-office, in collecting a great number of small parcels from very remote quarters of the kingdom to one spot? —He does.

Q. What inference do you draw from the Post-office being so used by a gentleman who is himself the manager of the largest railway system in England?—It seems to imply an admission of the very inferior organisation of the railway companies for the purpose of transmitting small packages; and it also, I think, indicates the enormous inconvenience which would be sustained by the public if any attempt were made to withdraw the privilege. It will be seen by Captain Huish's evidence, that the Post-office was employed, not only for the collectien of articles on a special occasion, but that, after that occasion had passed by, certain articles continued to be transmitted through the Post-office to Captain Huish's house.

Q. Does it ever happen that a parcel cannot be prepaid by railway from any one place to some other?—I believe that, on the northern side of the Thames, it is possible to send a packet, and to pay the carriage in one sum, from any town to any other town upon the same system of railways; but it is not so on the southern side of the Thames. I took occasion to make the inquiry a few days ago. I was at Brighton, and I found that I could not have pre-paid the carriage of a parcel from Brighton to Dover; and the honourable Member on my left (Mr. MacGregor, a railway director,) will probably be able to tell the Committee whether it would be possible to pre-pay the carriage of a parcel from Dover to Brighton. I have ascertained that it is not. Here you have two lines, which are so closely connected that one may be considered as a branch of the other.

Q. You consider the distribution of small parcels by the Post-office a convenience to the public?—An enormous convenience to the public.

Q. Do you think it is disadvantageous to railway companies?—I do not believe that it is. In the first place, I believe that, if the transmission of them were to be abandoned by the Post-office, very few of those parcels would go by railway; and next, I am quite satisfied that the practice of the Post-office conveying parcels has been so prominently put forward by the railway companies as a hardship upon them, that the awards have been very seriously affected thereby; and I have not the slightest doubt that the railway companies are deriving a much higher profit through the Post-office, in respect of parcels, than they could possibly obtain if they carried the parcels themselves.

Q. Upon what ground do you say you do not think these parcels, if not conveyed by the Post-office, would not be conveyed by railway?—I believe my statement was, that the greater part of them would not be conveyed by railway, for this reason: that the railway companies have not the means of collecting and delivering them, and also because a large number of those parcels, as has been shown in evidence, are charged at very low rates. The companies charge rates so very much higher, that the imposition of those rates would, in all probability, prevent the transmission of most of the parcels. If I recollect rightly, fully three-fourths of the parcels in question are under the weight of two ounces; that is to say, they are carried at rates varying from a penny up to fourpence, and many of those go enormous distances; so that any charge which a single railway company might make upon those parcels must either be exceedingly small, or it must be such that the accumulation of charges would altogether prevent their transmission.

Q. Admitting, as you of course do, that there is a certain amount of competition between the Post-office and railway companies for the carriage of parcels, would you not say that that competition extended only to a small number of those so called parcels that we have been told are sent out from the General Post-office?—I should say that, if a law were passed forbidding the Post-office any longer to carry the parcels in question, very few of those parcels would be sent by the railways, or by any other means.

Q. You do not think people would send pill-boxes and other things of that sort to the other end of Scotland or Ireland?—Certainly not.

Q. Not if they could not go by the Post-office?—No.

Q. That is a startling proposition?—It is one that I am quite prepared to maintain, however startling it may be.

Q. You limit your observation to single pill-boxes?—Certainly. I dare say Morrison would continue to send his pills all over the kingdom; but then they would not go in small quantities, but in large quantities, and the amount of benefit that the companies would obtain from them would be very trifling, and far less, I hold (and that is the important point), than they now get.

Q. Then the difference, if I understand you, is this: that in the one case you do not doubt that so far as the aggregate weight of packages is concerned, the railways are undoubtedly affected by what the Post-office carries; but that the packages separated into small parcels, or what is called the small parcel trade, would not be materially affected if the Post-office did not carry them?—I am of that opinion.

Q. The same aggregate weight would still be carried by railways, whether the Post-office carried it or the railways?—Perhaps so, but if the Post-office pays in respect of the parcels that we carry as high a rate as the public WOULD PAY FOR THE CONVEYANCE OF AN EQUAL WEIGHT MADE UP, NOT IN SMALL PARCELS BUT IN LARGE PACKAGES, IT NECESSARILY FOLLOWS THAT THE COMPANIES ARE NOT INJURED IN THE SLIGHTEST DEGREE; ON THE CONTRARY, SO FAR AS OUR ORGANISATION TENDS TO INCREASE THE NUMBER OF ARTICLES DISTRIBUTED OVER THE KINGDOM (AND THAT IT DOES TEND TO INCREASE THEM NO ONE FOR A MOMENT CAN DOUBT), THE COMPANIES THEMSELVES ARE BENEFITED.

Q. In point of fact, you being in the Post-office, which represents a public service, compete with private individuals who have constructed the railways?—The private individuals, when they constructed the railways, had no monopoly of the parcel traffic given them; on the contrary, the honourable Member is perfectly well aware that the early railways were established simply as roads. It was not contemplated in the early legislation upon the subject that railway companies should carry anything; they were simply and solely the owners of the roads; subsequently to that, the penny postage was established. Now, the Act establishing the penny postage dates as far back as August, 1839; since that time a large majority of the railways now open have been established; and therefore, if there is any robbery at all [some of the companies having presumed to use that term], it is a robbery by the railways of the parcels that ought to go by the Post-office; it is the Post-office, therefore, that is entitled to complain of the railway companies stepping in and robbing them. The truth is, however, that both parties are bound to serve the public in the best manner they can, and there is no robbery on either side; those will get the custom who perform the duty most effectually.

Q. You leave out of sight, then, asks an honourable member, a railway director, advocating the supposed interests of the companies, the fact that the railway company with which you were connected, and the one with which I was connected when we met on railway affairs, each obtained their Act of Parliament on premises which showed that they relied on a certain amount of parcel traffic to produce a dividend for their subscribers?—I cannot speak certainly to the fact, but I very much doubt if there was such reliance; I say that the railways which were constructed many years ago, were all constructed on the expectation that the companies would be simply the owners of the railways, and that is the reason why tolls were inserted in the several Acts of Parliament. The expectation was, that other people would place their engines and carriages upon the railways, and compete one with another. That was the theory, as every gentleman present must be aware, of the early railway system.

Q. But you cannot dispute this: that if, as you say, neither party has any right to complain to the other, when you come to an arbitration between the Post-office and the railway companies, the fact of your competing with them for carrying parcels is a material element to be taken into consideration?—I must contend, it is an element which ought not to be taken into consideration at all. All the arbitrators have to do is to ascertain the weight of the mails, including these parcels; and the hindrance, if any, caused to the working of the line by the Post-office requiring the train to be run at certain hours, and the expense of running at those hours. I hold that they have nothing to do with the question as to what are the contents of our mail; and I would add, in support of that position, that the courts of justice have lately decided that the companies are not entitled to open packages with a view of ascertaining the contents and charging accordingly; they have nothing to do but to ascertain the gross weight.

Q. You deny any claim that the companies have under the arbitration, on the ground that you are competing with them on their own line of railway for their own traffic?—Certainly, I deny it.

Q. But you do not compete with them more than many other individuals do?—Certainly not.

Q. You compete with them by carrying and paying for upon their line in one form, what might be carried and paid for in a different form?—Certainly; and I hold that, if it be a competition, it is one highly advantageous to the companies themselves. *I believe that the railway companies could not take a step more injurious to themselves than one which would deprive us, if it were in their power, of the right of collecting and delivering parcels, for I hold that that is what we do. We collect the parcels and we deliver them, and we pay the railway companies and others for their conveyance.*

Q. That is parcels paying letter rates, and which now pass through the Post-office since the last arrangement?—Yes, since the abolition of the limitation as to weight.

Q. A good deal has been said about the interference of the Post-office with the railways in conveying parcels, and it has been stated more than once that of late years, since this regulation was made, the number of small parcels sent by the railways has very much diminished; is it not the fact that since that time a decision has been come to in the courts of law, by which it has been declared to be legal on the part of traders to collect small parcels, and send them in one large package by railway at the ordinary rates of parcels?—Certainly."

The railway directors alleged considerable loss from the carriage of a parcels by the post. Captain M. Huish was asked—

Q. Have you any remarks to make upon the carriage of parcels by the Post-office?—No further than that we consider, and think we have reason to consider, that the Post-office is our great competitor for the carriage of small parcels, and that it has very materially indeed affected our revenue.

Q. To what extent do you suppose?—It is impossible for me to say to what extent; it must be an estimate, but I have very little doubt in my own mind that the abstraction by the Post-office of our small parcel traffic has been very nearly, if not quite, equivalent to the whole amount we receive for carrying the mails.

This witness estimated the loss at £55,000 per annum

for the London and North Western Railway alone, which at the same rate for all other railways of Great Britain, would make the total loss to them upwards of a million per annum, or nearly equal to the net revenue to the public of the post itself. Other railway witnesses stated as a fact, in general terms, that "great loss" occurred to their respective lines from the Post Office competition. Now, it turns out that the total amount of money received by the post for the transit of parcels was at that very time little more than £16,000 per annum for the whole kingdom—a fact in itself proving the prohibitory nature of the present rates for small parcels. The very small sum may be cited in support of the Committee's conclusion that the present rates of the post itself are, to a large extent, prohibitory, as are also railway charges, and must be. It may be here observed, that in those continental states where the post is used for the conveyance of parcels to an extent beyond anything which is here contemplated, as expedient, or as practicable, under the system of perfectly free private conveyance proposed, with much dearer coals, dearer iron and materials, with one-third lower rates of fares even for the like speeds and better accommodation to the public, the return on the capital invested averages upwards of 5 per cent. as against the general average of little more than 3 per cent. yielded to the capitalist by the existing railway management in England. In respect to the inability of the railways to deal with the delivery of the smaller parcels, and the public utility of a parcel post, the manager of the London and North Western Company gives testimony. Captain M. Huish was asked—

"*Q.* The evidence given by Mr. Hill is, that the up-parcels do not form anything like one-half of those which go by the down mails?—We find, taking a series of years, that our up-parcels into London are about one-half of those which go out of London. I might give a very striking illustration of this subject which fell under my own personal observation. Last year I had a bazaar in my grounds near London for a very popular object connected with Ireland; about £2,000 worth of work was sent to Mrs. Huish for this bazaar; it was very well attended, and a number of titled ladies were kind enough to assist in it. My connection with that bazaar first gave me an insight into the working of the Post-office, for although I will not say that a grand piano came by post, everything short of it for this bazaar came by post. Of these £2,000 worth of worked slippers, and all the endless things which ladies made for the bazaar, a great quantity came by post [it being perfectly free to the railways to have collected and delivered them at the same very high price]; it did not terminate there, for a very large amount of the work which came from Ireland through the post was composed of that beautiful work for which the Irish schools are so celebrated; by means of the bazaar it was brought to the acquaintance of a number of ladies in London, and the result has been that since that time Mrs. Huish has established a complete system of trade with those schools, and she gets over every day lace, and all sorts of things, by post, not any of which ever goes by the railway company." [We may add, not one of which, probably, could be carried by the railway company without separate porterage, a charge which would be prohibitory.]

Q. With reference to the parcels which came from various parts of Ireland, and the schools which are dotted over the whole of the interior of Ireland, the west coast, and everywhere else, do you believe *it is possible*, by any combination of railways which exist at the present time, with steamboats, that those parcels could have reached London with the same punctuality and ease that they did by the Post-office?—They would not have reached London quite *so cheaply* [the charge by post being a high one], I am aware; but I should like to have tried if I could not have brought them quite as correctly."

"*Q.* As you are perfectly aware, those schools are dotted all over Ireland, upon private estates and in villages, and are matters of social improvement taken up by private individuals in the different localities of Ireland; do you think it possible, without an enormous expense, which would be far more than tantamount to any gain, to organise any system by which those parcels could reach London from all those innumerable points, with any degree of punctuality?—I am quite prepared to admit that the public does derive a very considerable advantage from the fact of the postal arrangements being in one hand, instead of being divided between a number of railway corporations, who have to work into each other's hands; I do not intend to bring this instance forward as a real grievance, to prevent the Post-office pursuing the system, but only as an illustration of the sweeping way in which the Post-office competes with us for parcel traffic; I admit what Mr. Rowland Hill has said, that we have no monopoly of parcel traffic, and do not ask for a monopoly."

"*Q.* Is it not one of the greatest conveniences which the public have in consequence of the plan pursued by the Post-office, that the Post-office is a direct communication, not by railway only, but they use railways where railways are effective, and steamboats where steamboats are effective; and where neither of those plans suit their convenience, they are obliged to have recourse to other means to reach every village in the United Kingdom; so that there exists a direct means of communication almost as speedily as can be obtained under the circumstances of the case, with every part of the United Kingdom?—That is so, undoubtedly; I do not desire to deprive the extreme districts of that convenience, or the outlying rural parts, of the advantage which they now possess, but I think it is carried a little too far; and it would not surprise me any morning to find barrels of oysters with penny stamps upon them, carried over the kingdom as post letters."

The case of the bazaar is one on which the Society of Arts might rely as parallel to its own experience in respect to the collection and transmission of objects of art for its own exhibitions. But it is highly illustrative of the sense in which the word "cheapness" is used by the railway companies; that when it is admitted by the witness in behalf of the company that they could not have carried the parcels "quite so cheaply" as the post, the cheapness referred to was a rate of two shillings and eight pence per pound, or no less than £298 per ton.

In a letter by Mr. E. J. Page, the Inspector-General of Mails, published in the Appendix to the second report of the Postmaster-General, a further illustration is given of the principle in question. He states, as bearing upon the comparison of the railway and postal facilities for the conveyance of book parcels (which we submit as equally applicable to all small parcels)—

"As bearing strongly upon this comparison of facilities, I may mention the somewhat remarkable fact, that copies of the very report of the Committee of Consultation of the London and North-Western Railway, in which the Post-office is represented as unduly competing with railway companies for the carriage of books and parcels, were extensively circulated to that Company's shareholders through the medium of the book post, not merely to towns and villages at a distance from their railway, but even to Liverpool, to which the Companies' own trains might have carried them without any charge whatever. When it is recollected that there are about 10,500 post-offices scattered throughout the United Kingdom, that there is scarcely a village without a post-office, and scarcely even a hamlet without a regularly established official means of communication with a post-office, and that consequently persons even in the most secluded districts can communicate by post with all parts of the kingdom with tolerable certainty, and with very little trouble or expense, it will readily be seen that such facilities as these must lead to the transmission of

books and documents [and small parcels of all kinds] which otherwise would never be sent."

He adds further:—

"Now, even assuming for a moment that every book parcel which the Post-office carries is abstracted from parcels which would otherwise be conveyed by railway, it is obvious that the companies would not sustain any loss by such parcels becoming part of the mail, if the Post-office paid to the companies for its mails rates only as high as the booksellers pay them for their parcels, in which, for the most part, such books would be conveyed, if they were sent at all. But it is a matter of fact, that the general rates paid by the Post-office to railway companies are largely in excess of those paid by the booksellers for their parcels. It follows, therefore, that the companies, instead of being injured, would be benefited by any such abstraction, seeing that, besides receiving a higher rate of remuneration for the carriage of these book parcels, they are entirely relieved of the cost of collection and delivery, a cost which, as Mr. Stephenson shows, renders goods traffic less profitable to railway companies than passenger traffic."

Mr. G. A. Saunders, the manager of the Great Western Company, alleges that they could carry parcels as punctually as the post, but he admits exceptions which, when examined, establish the whole case for utilising the post.

"*Q.* Do you think the railways could organise any plan by which parcels could be delivered as punctually and conveniently by them us they are now by the Post-office?—I think they can be delivered just as punctually and conveniently, *with the single exception* [*i. e.*, eight or ten thousand] *of the more remote places where we have not got delivering agents;* in which case the Post-office bags taken to particular places possess an advantage over us, and it is there principally that they obtain the parcel trade.

"*Q.* You would have more difficulty than the Post-office have, would you not, in sending parcels into remote villages?—There is no doubt of that [that is to say, in the vast majority of cases]. With regard to parcels I would make this observation, that we avail ourselves principally of the mail-carts that are running to and from our stations, and we make them the parties to carry these very parcels to and from different districts in the country; I believe that one great advantage the Post-office derive from the mode in which we carry on our business in combination with them is, that they get their mail bags carried much cheaper between the stations and the surrounding country, because these mail-carriers derive a benefit from the distribution of our parcels; for instance, at Chippenham station, whence the bags are distributed far down in the lower part of Wiltshire, the mail cart owners who carry those mail bags make a considerable profit out of the parcels that we give them for distribution.

"*Q.* You say that you make use of the *mail-carts* to a great extent for the conveyance of *your own* parcels?—Yes; if you send a parcel from London to Malmesbury, for instance, that parcel is charged from London to Malmesbury, and it is composed of three different portions of amount; for bringing it to Paddington, 3d. is paid; for taking it from Paddington to Swindon, 9d. is charged; I am assuming those sums; and then the carrier gets his 3d. or 4d. for taking it over to Malmesbury. The way in which these people are paid for it is by getting their proportion out of the whole charge made for the parcel; we hand over those parcels to the mail carrier, and his gain is derived from the whole portion of the charge as between the railway station and the place of ultimate delivery."

According to the witnesses, they use the mail-carts, and thereby send goods free of toll, on those turnpike trusts which are prohibited from taking more than five per cent. interest,—which have been deprived of paying traffic, and have been extensively injured by the powerful competition of the railways.

"*Q.* From the extensive means the Post-office have of delivery, they certainly have the preference, to some extent, as carriers of parcels, have they not?—*No doubt they possess advantages over the company.*"

If the number of receiving-houses or delivering-houses of the largest company in the metropolis, be compared with the number of the receiving-houses and the deliveries of the Post-office, the case would be decisive for the adoption of a general public agency. But it is the remote suburbs of the metropolis, and the larger towns, the remote villages, the remote farms, and the remote gentlemen's seats—which comprise the larger bulk of the population—which are not to be reached without a new and separate agency; and in respect to them, it is demonstrable that, if the railway companies or any private carriers were to establish a new and separate and universal porterage, and were to charge only the prime cost of the labour of that new porterage, and nothing for any new investment, that separate charge must, to be remunerative, be prohibitory of the convenience and the traffic now contemplated.

In fact, as maintained by Mr. Rowland Hill (himself a railway shareholder, and formerly chairman of the London and Brighton Railway, one of the best administered railways in the country), it is conclusively established to be to the interest of the companies themselves that the Post-office should act as collectors and distributors of these small parcels, which the companies or private carriers cannot everywhere collect, or everywhere distribute themselves. It is clear that the post must thus largely augment the main traffic of the railways, for which they charge so highly and profit so largely upon the actual expense of conveyance.

The effect upon common carriage of the change we propose, appears to be, in some respects, exemplified by the change occasioned by the abolition of the compulsory newspaper stamp.

When the stamp was compulsory, and when it conferred the privilege of free transmission, the great bulk of the stamped papers were conveyed by post. Since the abolition of the compulsory stamp, the number of newspapers conveyed by the post has been reduced to one-third the previous amount; the cheaper modes of private carriage being now resorted to for the conveyance of the bulk; the smaller proportion, still transmitted by post, being exceptional cases, where there are no regular newsvendors cheaper deliveries, and where the postal delivery must be resorted to, from the alternative of the expense of separate porterage being prohibitory. The bulk of the parcel or goods transmission would remain with the railways or with private carriers, and the bulk of the carriage along the main lines would be augmented by the amount of small parcels which will hereafter be sent at the book parcel rates, composed of the exceptional cases where the expense of separate porterage is now prohibitory.

The facts confirmatory of this view are thus stated by the Inspector General of Mails, Mr. Page, in the document already cited:—

"It has been ascertained," he says, "with regard to the night mails from London, by which by far the largest proportion of books is conveyed, that the reduction in the number and total weight of newspapers conveyed by these mails, since the alteration in the Newspaper Stamp Act, is more than *six* times the total number and weight of *all the book parcels.* To show the extent to which weight has thus been abstracted from the mails, I may mention that the number of carriage loads of bags sent from the General Post-office to the Euston-square station on Friday nights, has, since the recent Newspaper Stamp Act took effect, been *five* less than previously, and that the average nightly reduction of weight of newspapers despatched from London is upwards of *two tons and a-half.* At the same time it is

beyond doubt, that the effect of the Act in question has been largely to increase the newspaper circulation of the kingdom, and consequently to add still further to the earnings of the railway companies."

"In fact," he says, "the book post service [to which we add the small parcel service] is one so different in its character and objects from that to which the parcel arrangements of the railway companies are adapted, that it may fairly be assumed it would hardly exist at all but for the extensive facilities for its development which the Post-office possesses. The evidence given before the Select Committee on the Conveyance of Mails by Railways (1854), especially that of Mr. Charles Knight, the eminent publisher, is very decided on this point. He says (3,872), 'that the cases in which books are sent by post may be nearly all considered as exceptional cases to the ordinary commercial operations of publishing,' and again (3,870) and (3,892), 'that the book post may be looked upon as a mere auxiliary to the conveyance of parcels by other means,' and (3,860) 'that if the existing regulations were stopped, the public would not be able to derive the same advantages through any other channel.'"

The conclusion may be adopted for the general small parcel conveyance by post, from the experience, as above stated, of the book conveyance by post, that at the like rates it will be simply auxiliary to any conveyance of parcels by other means, which open competition may supply at lower rates.

In such instances as that of the Bazaar, only the lightest description of articles could have been forwarded, and many important contributions must have been excluded which could not have borne the present rates of parcel carriage. The railway companies would not, for their own book distribution, think of subjecting themselves to the charge for separate porterage.

There were on the Committee of the House of Commons the chairmen of two large companies, and considerable shareholders. Nevertheless, the following resolutions appear to have been passed unanimously,—the objection to the public right and principle of a parcel-post may be assumed to have been abandoned by the chief representatives of the companies.

"From a personal inspection of the Post-office on the day alluded to by Mr. Hill," say the Committee of the House of Commons, "your Committee have reason to believe that a large proportion of these parcels were of a sort which would not be sent, but for the facilities afforded by the Post-office in their distribution.

"It is, however, undoubtedly the case" [the contrary, it may be observed, was very clearly proved], "that a considerable amount of parcels is thus abstracted from the usual means of conveyance, and that the Post-office is become, to that extent, a competitor with public carriers.

"Your Committee by no means recommend that the present practice should be abandoned; *on the contrary, they believe that incalculable advantages are derived from it by the public, not only as regards convenience in the transmission of common parcels*, but more particularly in the diffusion of literature and knowledge in country districts, which could not be approached with equal facility by other means."

The decision of the Committee of the House of Commons, and more particularly the evidence given before that Committee in the course of the important investigation, will be found an impartial examination in complete concurrence with the conclusions first stated in this report. The committee's decision establishes, upon the postal experience and testimony, the principle of a general small parcel post for the benefit of the public, and indeed for the real interests of the railway shareholders themselves.

What some persons call leaving the business of conveyance to the "free course of trade," is, in fact, leaving the public conveniencies and necessities to multiform irresponsible monopolies. To dispense with the services of a public and nearly universal porterage—to forbid them to be exercised in free competition, even at high charges on the working expenses, is to maintain a protectionism of the worst sort.

The returns show that whilst 13 per cent. only of the weight of the mails carried is made up of letters, and 2 per cent. of book parcels, no less than 75 per cent. of the weight formerly conveyed consisted of newspapers.

From the calculations of the deficit of revenue, but, above all, from the cheaper rate at which it will be practicable to convey large parcels, in which the newspapers may be conveyed along the main lines at less than fourpence per lb., the reduced rate at which printed matter is carried, it appears to be highly probable that a void will have been occasioned in the public mail bags for some time at least, by the proposed alterations of the law in respect to newspaper stamps. This void the improvement and extension of the small parcel postage would no doubt eventually fill up. We say eventually, because we believe that the increased effects of the improvement, important as they are, will be gradual.

In fixing the rate of postage for printed matter at fourpence per lb., it is to be presumed, and it is indeed clear, that the interests of the revenue have been fairly consulted. If no such rate had already been officially fixed, we should have proposed, that the charges for the establishment being already more than paid for, the amount of the extra service in collection and distribution, as well in main carriage required to be performed, should be carefully and impartially analysed, and its prime cost determined, and a fair profit allowed to the post and to the postal establishment, and also extra remuneration to the collectors and distributors.

By the opponents to the public parcel postage, it was alleged that it must impede the transit of letters. This allegation was decidedly negatived by Mr. Rowland Hill, who showed that a very trivial effect would be produced on the transit of letters if the parcel postage were taken away;—therefore, very little effect upon the dispatch of letters can be fairly anticipated from the gradual additions consequent on the proposed improvement of the parcel postage. The Committee apprehend that, with the additional emolument derivable from an improved and cheapened parcel postage, deliveries by the use of carriages or horses may be eventually extended, and the general transit be improved to an extent proportioned to the extension of business, as with all great private establishments.

The proposed parcel postage may be made the means of improving and completing the postal deliveries in rural and thinly-populated districts, where the deliveries are now very imperfect.

In France, the postal delivery is established direct to every house. In England, the delivery to every house is not complete, although, under the existing administration, it is rapidly tending to completion. It is to be hoped that the measure proposed may aid the more complete accomplishment of that important object.

The Committee of the Society, with their Chairman, Lord Ebrington, have availed themselves of a permission to see the central establishment at St. Martin's-le-Grand in operation.

One night's inspection of the ordinary business sufficed to convince the Committee that the present edifice is inadequate to the accommodation of the present postal service of the country. That edifice was designed for the old system of postage, in which artificial light was required, to examine letters, for their taxation for enclosures chargeable with double postage; it is dark, and heated to excess with the gas-lights required for the transaction of the present business; it is badly ventilated, and overcrowded, and must be injurious to the health of those who work in it, and who deserve every fair personal accommodation they can receive in the performance of their duty from the public. Since it was constructed, the business has increased more than sixfold beyond the amount for which it was designed. It is

understood that measures are being taken to remedy, as far as may be practicable, the want of ventilation, but the present building cannot be expected to be made suitable to the transaction, with proper comfort to the officers, of a five-fold mass of business.

If the postage business of the country were conducted, at the existing or the proposed rates of charges, as a commercial business, by a commercial firm, there would be no hesitation in immediately acting upon a determination to obtain new and more appropriate premises. The profits arising from the extension of the business, at the proposed rates, would be looked to as a means of obtaining more extended structural arrangements, and for putting the agency on a better footing, systematising completely the whole service.

The Committee confidently urge the adoption of the proposed measure, as one which will conduce to the improvement of the whole of our present postal system, and of the condition of the subordinate agents, and means of general distribution.

Whilst the Committee feel an entire confidence in the main principle of the measure they recommend—corroborated as it is by the powerful evidence recited—they would, as to the executive details, defer most respectfully and confidently to the ability and zeal prevailing in the postal department, by which one of the most important and brilliant administrative reforms of our time has been accomplished, not only for this country, but, by the influence of its example, for the civilised world.

The chief conclusions arrived at upon an examination of the subject are—

First, that the unavoidable labour, and consequent expense and uncertainty of the transmission of very small parcels, particularly over cross-country or through different lines of conveyance, whether by private means or by the public, is at present, in a large proportion of cases, prohibitory.

That the postal establishment, having an agency for the collection and distribution of letters, (or what may be termed an universal porterage, available for the collection and delivery of small parcels), may, without any materially increased establishment charges, and with compensation to the establishment and profit to the revenue, render to the public the increased service of the conveyance of small parcels, at an expense not exceeding that of the book postage, or at a cheaper rate, as respects such small parcels, than could possibly be accomplished by any separate agency for the purpose.

That it may render this service, as has been already done as respects the conveyance of books, without any serious detriment to legitimate private conveyance or railway service—but with increased profit to such private service by increased conveyance in bulk—arising from the increased transmission of small parcels, consequent on the increased convenience for their collection and distribution.

That the proposed extension of the postal service to the transmission of small parcels will be of great convenience and benefit to the arts, to practical science, to industrial occupations, and to family and trading intercommunication.

The Committee therefore propose to submit to Her Majesty's Government, that it will, for the special interest of the arts, and of trade, as well as for the general convenience of the public, as also in the interests of the revenue itself, and with extra pay for extra work, to the public servants performing it—exercise the authority with which it is charged, to remove the limitation of the proposed rates of fourpence per lb. to printed matter, and extend the conveniences of the postal delivery to all other matters, subject to the like limitations for postal convenience to which the book parcel postage is now subjected.

The Committee trust that a due consideration of the facts of the case, and the principles involved in the measure proposed, will have the concurrent support of the impartial members of the Chambers of Commerce and of the Institutions in Union throughout the country, to whose especial attention they commend it.

EBRINGTON, *Chairman.*
E. CHADWICK, C.B.
H. COLE, C.B.
PETER GRAHAM.
J. J. MECHI.
SAMUEL MORLEY.
J. A. NICHOLAY.
J. INGRAM TRAVERS.

A copy of the foregoing report has been sent to every Institution in Union with the Society, accompanied by the following letter:—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., 8th July, 1858.

Sir,—I am directed by the Council to forward you a Report, which has been presented to the Council by a Committee, on the subject of a Small Parcels Post.

This subject was, some time ago, suggested to the Council as deserving of careful consideration, and the Council appointed a Committee to report upon it.

This Report, a copy of which I send by this post, shows that the subject is of very great and general importance, and that it is only necessary to allow parcels to be conveyed at the same rate as printed matter to effect the object.

To enable the Council to take measures, by the Society of Arts, to advance this reform, it would be a great advantage if the collective opinions of the members or of the governing body of your Institution, upon the points raised in the Report, and upon the subject generally, could be produced to assist the judgment of the Council.

I am, therefore, to request that you will cause the necessary steps to be taken, by holding a general meeting of your members or otherwise, for obtaining an expression of the views of your members or managing body in reference to it, and that you will be so kind as to communicate the result to me as early as convenient.

I am, Sir,
Your obedient servant,
P. LE NEVE FOSTER, *Secretary.*

EXAMINATIONS, 1858.

Since the publication of the list of certificated candidates, the Council have received from the Local Board at Manchester proper forms of declaration, duly filled up and signed, referring to the papers worked in Arithmetic, Bookkeeping, Trigonometry, and French, by the candidates there. The Council have, therefore, been able to award to them Certificates as follows:—

Candidates' Numbers.

401—John Caw, aged 17, Manchester Athenæum, clerk—A Certificate of Excellence in Arithmetic.

404—Thomas Baker, aged 20, Oldham Lyceum, mechanic—A Certificate of Competency in French.

405—Thomas Crellin, aged 21, Oldham Lyceum, mechanic—Certificates of Proficiency in Arithmetic, and of Competency in Trigonometry.

406—Ralph Crompton, aged 23, Oldham Lyceum, weaver—Certificates of Excellence in Bookkeeping, and of Competency in Arithmetic.

410—Charles Henry Berrisford, aged 18, Stockport Mechanics' Institution, mechanic—A Certificate of Competency in French.

412—George William Davies, aged 19, Stockport Mechanics' Institution, moulder—A Certificate of Proficiency in Arithmetic.

413—Joseph Epton Hadwick, aged 20, Stockport Me-

chanics' Institution, mechanic—A Certificate of Competency in Arithmetic.

421—Matthew T. Higham, aged 19, Miles Platting Mechanics' Institution, warehouse boy—A Certificate of Competency in Book-keeping.

The subjoined letter has been addressed to the Secretary of the Oldham Lyceum, with reference to an irregularity in giving out the papers in Geometry and Algebra, which prevented the declaration required by the Council, in reference to the working of the papers, from being signed in its integrity by the Local Board:—

Society for the Encouragement of Arts, Manufactures, and Commerce, 8th July, 1858.

SIR,—I am directed by the Council of the Society of Arts to announce to you the decision which they have definitely taken in reference to the Oldham Candidates. The non-compliance with the regulations laid down for the guidance of the Local Boards cannot be passed over, and the Candidates are therefore disqualified from obtaining Certificates and Prizes. The Council much regret that these Candidates, from no default of their own, have become thus disqualified; but in order that the Candidates in all parts of the country may feel secure that the competition will be perfectly fair, the essential conditions which regulate it must be well known and strictly observed. They were fully communicated to the Local Board of the Institutional Association of Manchester, and the Council of the Society of Arts must support its regulations and maintain the disqualifications of the Candidates. You will probably be able to make better arrangements for conducting your Examinations at Oldham next year. The Council desire me to request you to present to No. 405, Thomas Crellin, the enclosed sum of £5, and to No. 406, Ralph Crompton, the enclosed sum of £3, as a present from this Society in token of its sympathy with the Candidates in the disappointment which they must necessarily feel.

These are the amounts which it appears from the report of the Examiners these Candidates would have received as Prizes if they had not been formally disqualified for receiving them.

I am, Sir,
Your obedient servant,
P. LE NEVE FOSTER, Secretary.

The Secretary, Lyceum, Oldham.

INSTITUTION OF CIVIL ENGINEERS.

The Council of the Institution of Civil Engineers have just awarded the following Premiums for papers read at the meetings during the past session:—

1. A Telford Medal, to James Atkinson Longridge, M. Inst. C.E., and a Council Premium of Books, to Charles Henry Brooks, for their Paper "On Submerging Telegraphic Cables."
2. A Telford Medal, to George Robertson, Assoc. Inst. C.E., for his "Investigation into the Theory and Practice of Hydraulic Mortar."
3. A Telford Medal, to James Henderson, Assoc. Inst. C.E., for his Paper "On the Methods generally employed in Cornwall, in dressing Tin and Copper Ores."
4. A Telford Medal, to Robert Jacomb Hood, M. Inst. C.E., for his Paper "On the Arrangement and Construction of Railway Stations."
5. A Telford Medal, to Major-General George Borlase Tremenheere, Assoc. Inst. C.E., for his Paper "On Public Works in the Bengal Presidency."
6. A Telford Medal, to Alfred Giles, M. Inst. C.E., for his Paper "On the Construction of the Southampton Docks."
7. A Watt Medal, and the Manby Premium to Guilford Lindsay Molesworth, Assoc. Inst. C.E., for his Paper "On the Conversion of Wood by Machinery."
8. A Watt Medal, to Thomas Spencer Sawyer, for his Paper "On the Principal Self-acting and other Tools employed in the Manufacture of Engines, Steam Boilers, etc."
9. A Council Premium of Books, suitably bound and inscribed, to Frederick Charles Webb, Assoc. Inst. C.E., for his paper, "On the Practical Operations connected with Paying-out and Repairing Submarine Telegraph Cables."
10. A Council Premium of Books, suitably bound and inscribed, to Henry Conybeare, M. Inst. C.E., for his "Description of Works recently executed for the Water Supply of Bombay, in the East Indies."
11. A Council Premium of Books, suitably bound and inscribed, to Samuel Alfred Varley, for his Paper "On the Qualifications requisite in a Submarine Cable, for most efficiently transmitting Messages between distant Stations."
12. A Council Premium of Books, suitably bound and inscribed, to Richard Carden Despard, for his "Description of Improvements on the Second Division of the River Lee, with Remarks on the Position of Canals generally."
13. A Council Premium of Books, suitably bound and inscribed, to Alexander Wright, Assoc. Inst. C.E., for his Paper "On Lighting Mines by Gas."
14. A Council Premium of Books, suitably bound and inscribed, to James Brunlees, M. Inst. C.E., for his "Description of the Iron Viaducts erected across the Estuaries Leven and Kent in Morecambe Bay, for the Ulverstone and Lancaster Railway."

It may be mentioned that two of these awards, the Watt Medal and the Manby Premium, are now presented for the first time. The former originated with the Council, who were desirous of possessing some distinctive means of rewarding excellence in communications upon mechanical subjects. The medal has been executed by Mr. Joseph S. Wyon. On the obverse is a beautifully-executed medallion likeness of James Watt, and on the reverse a representation of the steam-engine, as constructed by him. The Manby Premium is due to the liberality of Mr. Charles Manby, F.R.S., who has filled the office of secretary for the last nineteen years, and with so much satisfaction to the members, that a few months back they presented him with a clock and candelabra, and a cheque for £2,000. In acknowledging this handsome testimony of his services, Mr. Manby requested that the Council would receive debenture stock of the value of £200, bearing 5 per cent. interest, to be expended in an annual premium. In accepting this offer it was resolved that the premium in question should bear the title of the "Manby Premium."

SOUTH KENSINGTON MUSEUM.

During the week ending 3rd July, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,128; on Monday and Tuesday (free evenings), 3,861. On the three Students' days (admission to the public 6d.), 1,111; one Students' evening, Wednesday, 174. Total, 9,274.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 1st July, 1858.

348. East India—Home Accounts.
360. Dead Letter Office—Return.
366. Spirits—Return.
372. East India Company (sums repaid)—Return.
323. Cambridge University—Copies of Statutes.
165. Bills—Civil Bills, &c., (Ireland) Act Amendment.
166. ——— Corrupt Practice Prevention Act Continuance.
167. ——— Navigation Advances (Ireland).

Delivered on 2nd July, 1858.

353. Tobacco—Return.
357. Greenwich Hospital—Return.
367. Paper—Return.
368. Arterial Drainage (Ireland)—Return.
369. War Department (Purchase of Houses)—Correspondence.

Delivered on 3rd and 5th July, 1858.

371. Education (Mauritius)—Return.
355. Wheat, &c.—Returns.
373. Expiring Laws—Report from Committee.
374. Irremovable Poor—Report from Committee.
377. Emigration—Return.
378. Imports and Exports (British Colonies)—Return.
168. Bills—Universities (Scotland) as amended in Committee and on Re-commitment).
171. ——— Judgments (Ireland) Act Amendment.
174. ——— Four Courts (Dublin) Extension (as amended by the Select Committee).
170. ——— Government of New Caledonia.
172. ——— Admiralty Court.
173. ——— Superannuation Law Amendment.
175. ——— Detached Parts of Counties.
176. ——— Police (Scotland) Act Amendment.
177. ——— Lunatics (Scotland) Act Amendment.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July* 2, 1858.]

Dated 6th March, 1858.

460. P. A. Cap, Paris—An improved construction of billiard table for drawing-rooms.

Dated 19th May, 1858.

1112. H. Walker, Gresham-street—Imp. in the manufacture of needles.

Dated 29th May, 1858.

1214. T. V. Lee, Thames-chambers, York-buildings, Adelphi—Imp. in the construction of steam generators applicable to marine locomotive and all other uses where steam is applied as the motive power.
1216. D. Hebson, Liverpool—Imp. in ships' gear, part of which is applicable to forming ropes for general purposes.

Dated 3rd June, 1858.

1248. T. Scholefield, Paris—Imp. in gas meters.

Dated 8th June, 1858.

1286. R. Wappenstein, Manchester—Imp. in the manufacture of artificial whalebone, applicable to umbrellas, parasols, stays, hats, bonnets, reeds, crinolines, and other similar purposes.
1288. J. C. Quince, Crosby-hall Chambers, Bishopsgate—Imp. in stoppers for bottles and jars.
1292. J. Bunnett, Deptford—Imp. in the construction of floors, roofs, and arches.
1294. J. Rawlings, Collingbourn Ducis, Wiltshire—Imp. in thrashing machines.

Dated 9th June, 1858.

1296. G. Suares, 1, Cullum-street, Fenchurch-street—An imp. in fire-arms. (A com.)
1298. D. Moseley, Chapel Field Works, Ardwick—Imp. in machinery used in the manufacture of vulcanized india-rubber thread.
1300. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for sowing grain. (A com.)
1302. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the construction of railway wheels. (A com.)
1304. J. Easterbrook, Sheffield—An imp. in ratchet braces.
1306. T. W. G. Treeby, 1, Westbourne-terrace Villas, Upper Westbourne-terrace, Paddington—Imp. in revolving fire-arms and cannon and cartridges.
1308. T. Robinson and H. Ogden, Manchester—Imp. in safety lamps, and in apparatus connected therewith.
1310. C. Cammell, Cyclops Steel Works, Sheffield—Imp. in railway buffers.

Dated 10th June, 1858.

1312. G. Castle, 10, Tamworth road, Croydon—Ventilating women's stays by means of perforation.
1314. J. Luis, 1B, Welbeck-street, Cavendish-square—An alembic wine examiner. (A com.)
1316. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved balance-beam thrashing machine. (A com.)
1318. T. Chatwin and C. Taylor, Birmingham—Imp. in screw stocks.
1322. H. Reynolds, King William street—An improved method of separating glycerine from saline and other substances.
1324. W. C. Wilkins, Long Acre—Imp. in lighthouses.

Dated 11th June, 1858.

1328. G. Bartholomew, Linlithgow, N.B.—Imp. in that description of gas meters commonly called wet meters.
1330. S. Cheavin, Spalding—An improved preparation or combination of mineral substances, applicable for use as a pigment, cement, or mastic, or to be used either alone or in combination with other well known materials for washing, scouring, cleansing, or bleaching purposes.
1332. G. W. Hart, 5, Osborn-terrace, Southsea—Imp. in the manufacture of locks.

Dated 12th June, 1858.

1334. G. T. Stieler, Manchester—Imp. in the means for generating steam and economising fuel.
1336. W. Clark, 53, Chancery-lane—Imp. in machinery for combing cotton and other fibrous material. (A com.)

Dated 14th June, 1858.

1340. W. Clark, 53, Chancery-lane—Imp. in curtain poles or rods. (A com.)
1342. H. J. Daniell, Donington-park, Derbyshire—A process by which the stamp on bankers' cheques is cancelled, and the cheque indelibly and simultaneously crossed.
1344. G. Neall, Northampton—Imp. in gas stoves for warming, cooking, and other purposes; as also in the saucepans, kettles, or other utensils to be used with the same.
1346. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for breaking or crushing stones for road metal, and other purposes, and for crushing ores and other hard and brittle substances. (A com.)

Dated 17th June, 1858.

1369. J. H. Marsden, Manchester—Certain imp. in the manufacture of hats.
1371. J. Haslam, Preston—Imp. in looms for weaving, and also in shuttles and pickers connected therewith.
1373. A. Dawson, 14, Barnes-place, Mile End-road—Improved apparatus for converting small coals or coal dust, or small coals and coke, or coal dust and coke, with the admixture of water or other materials into artificial fuel.
1375. S. Taylor and D. Taylor, Rochdale—Imp. in machinery or apparatus for putting machine straps or belts on to pullies or drums, and for removing the same.

Dated 18th June, 1858.

1379. R. S. Newall, Gateshead—Imp. in the manufacture of cords, ropes, and cables.
1381. P. B. E. Martin, Paris—Imp. in obtaining electro-motive power.

Dated 19th June, 1858.

1383. S. Hewitt, Manchester—An improved application of printed designs to cotton and other fabrics, and for imps. in the treatment during the processes of printing and finishing such fabrics.
1385. J. Bradshaw, Bolton-le-Moors—Certain imp. in apparatus for obtaining and producing motive power.
1387. R. Winans and T. Winans, Baltimore, U.S.—A new and improved steam vessel.
1389. R. Winans and T. Winans, Baltimore, U.S.—A new and useful imp. in the mode of combining the engines and propeller shafts of steam vessels.
1391. H. Becu, Merville, France—Imp. in the manufacture of lathes, and in fixing and nailing the same.

Dated 21st June, 1858.

1393. H. H. Henson, 38, Parliament-street—Preserving or waterproofing ropes, strands, cordage, cables, and other similar articles.
1395. R. A. Brooman, 166, Fleet street—Imp. in treating wood to preserve and colour it, and in apparatuses to be employed therein. (A com.)
1397. J. Crossley, St. Helens, Lancashire—Imp. in machinery for grinding, smoothing, and polishing glass.
1399. W. Thrift and A. High, Bedford-street, Commercial-road East—Imp. in house water closets.
1401. A. V. Newton, 66, Chancery-lane—An imp. in the manufacture of spoons and forks. (A com.)
1403. G. R. Scriven, Philadelphia, U.S.—An improved apparatus for ventilating, and for circulating, moving, or otherwise acting upon air or other fluids.

Dated 22nd June, 1858.

1405. M. Mayall and G. Jackson, Mossley, Lancashire—Imp. in machinery or apparatus for spinning cotton and other fibrous substances.
1407. W. Galloway and J. Galloway, Manchester—Imp. in machinery for cutting, bruising, chipping, and rasping, and otherwise treating or preparing dye woods and roots, or other vegetable substances.
1409. J. A. Rainé, 16, Wells-street, Gray's-inn-road—Imp. in collapsible framework for bedsteads, sofas, and other like articles of furniture.
1411. P. Brown and B. Young, Spa-road, Bermondsey—Imp. in the manufacture of white lead.
1413. J. Robertson, Glasgow—Imp. in apparatus for regulating the flow or passage of fluids. (A com.)

Dated 23rd June, 1858.

1415. T. Spencer, 192, Euston-road, Euston-square—Imp. in the treatment of iron ores and ferruginous sands, and certain applications arising therefrom.
1417. P. J. Livsey, Manchester, and F. L. Stott, Rochdale—Imp. applicable to machinery for warping yarns or threads.
1419. R. Armstrong, North Woolwich—Imp. in steam-boilers and furnaces. (Partly a com.)
1421. R. Rumney, J. Mellor, and W. S. Macdonald, Manchester—Imp. in dyeing and printing cotton, wool, silk, and other materials and fabrics.

WEEKLY LIST OF PATENTS SEALED.

July 2nd.

17. J. Platt.
58. J. B. A. Couder.
85. V. De Tivoli.
106. W. White.
140. W. E. Newton.
144. J. Harthan and E. Harthan.
618. C. N. Kottula.
986. J. G. Appold.

July 6th.

22. J. D. Malcolm.
23. M. L. J. Lavater.
26. F. P. Cappon.
27. J. Reilly, junr.
29. R. and J. Philp.
34. P. Soames and J. C. Evans.
35. R. A. Brooman.
36. H. Atkins.
151. C. N. Kottula.
293. H. Wilde.
617. C. N. Kottula.
619. C. N. Kottula.
999. W. S. Hollands.
1013. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

June 29th.

1502. R. Tidmarsh.

July 3rd.

1499. R. Muckelt.
1520. J. Beckett and W. Seed.

Journal of the Society of Arts.

FRIDAY, JULY 16, 1858.

MEETING OF COUNCIL.

The following Institution has been taken into Union since the last announcement :—

Whitby, Institute of Popular Arts, Science, and Literature.

SPECIAL PRIZE.

The Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. French and J. MacGregor, Esq.,) and the Society's Silver Medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., will be awarded according to the following conditions :—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breadth must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*— It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

Competitors are desired to take notice that the Council reserve to themselves the right of withholding the prize should there be no article of sufficient merit brought under their notice.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 1st of January, 1859.

PRODUCE OF WESTERN AUSTRALIA.

Samples of Olive Oil and of Raisins have been forwarded to the Society from the Chamber of Commerce, Freemantle, Western Australia, which are stated to be the produce of that colony. The Council have been favoured with the following reports as to their quality and commercial value from the gentlemen to whom they were referred for examination :—

May 27, 1858.

Dear Sir,—The sample of raisins submitted to me for my opinion is in bad condition, much candied, and would not keep many weeks longer; its present value is not more than 35s. per cwt., duty paid (10s. being the duty). Apart from its present condition I consider it fine fruit; its flavour is peculiar; but, in my opinion, the public would soon get used to like it for cooking purposes. It would not, however, sell with, or instead of, what we term Muscatels, the fruit that is used for our table. It is not good enough for that, its skin is too thick, and the flavour is not delicate enough for that purpose.

But to render it fit for cooking, the raisin should be differently cured. The Valencia raisin, which we now mainly use, is, before drying, dipped into a hot wash, which acts chemically on the skin, and literally cuts it, so that the fruit boils quickly out, and gives a richness to the pudding which cannot be obtained from merely sun-dried fruits. Thus, although many different kinds of raisins are imported into England, the Valencia produce has always, and often under the most adverse circumstances as to price and quality, maintained its preference. The wash used in Valencia consists of water which has been passed through a barrel filled with wood ashes, mixed with a very small quantity of lime; this is raised to boiling point, and the fruit rapidly dipped through it. Too strong a wash, or the fruit being at all left in it, will utterly destroy the grape; but a little practice will soon show this. The lime also must be used very sparingly, a quart being enough for a large barrel full of the wood ashes. Some sorts of wood, such as the fig, are objectionable.

And as to the probable price this Australian fruit, dressed in this way, and put into convenient packages, would bring, I should say that nothing above 45s. must be expected; from this, if you deduct duty, 10s.; landing charges, &c., 1s.; commission expenses, 1s.; freight, &c., 3s.; about 30s. would be left. It must be remembered that our great season of demand is from September to Christmas, and that all fruit arriving after that time is at a disadvantage. On the other hand, the blight has damaged the quality and reputation of Valencias, so that this Australian fruit, which appears quite free from taint, would, with many, have a preference. Its dark colour is a bad point,—probably this would be softened by the mode of dressing I recommend. I will only add that great care should be taken in packing and preparing the first quantity that may be sent to this market, so that the first impression may be good. For so long a voyage barrels would be better than boxes, but they should not be too large, certainly never beyond 3 cwt., and better if they did not much exceed 1 cwt.

Yours faithfully,
J. I. TRAVERS.

To the Secretary of the Society of Arts.

William-street, Blackfriars, May 28, 1858.

Sir,—We have carefully examined the sample of oil from Western Australia, and are of opinion that it is, as represented, a pure olive oil; specific gravity 917·3, and the reactions of chemical tests correspond thereto. It appears to us not to have been very well prepared, but we have no doubt that with improved means a better result would be obtained. We consider its present value to be about £48 per ton, delivered in London, and that it would be likely to meet a tolerably ready sale.

We are, sir, yours faithfully,
CHARLES PRICE & CO.

P. Le Neve Foster, Esq.

182, Piccadilly, June 3, 1858.

Dear Sir,—In compliance with your request for our opinion of samples of olive oil and raisins, the produce of Western Australia, the results of comparison enable us to report very favourably on the quality of the former, which, we consider, for domestic uses fully equal to the importations from Leghorn, but bearing a closer resemblance to the oil from the South of France, which by many is even considered preferable. Such oil is now realising from 5s. 6d. to 6s. 6d. the gallon in this market, and reaches here in pipes of 108 gallons, also in hogsheads and jars; but the greatest care must be taken that whatever package is used must be perfectly free from any taste or smell likely to interfere with the delicate flavour of the oil.

Respecting the raisins, we much fear they would not be likely to prove a safe article for this market, which

is so well supplied from Spain; and we think the long voyage they would be subject to would greatly tend to deteriorate the quality, as all fruit is liable to fermentation by long stowage. The sample sent appears to us of various qualities, partaking of different characters, some evidently being of the Valencia, others of the Muscatel kind. Such fruit would not realise more than 28s. to 36s. in this country; but as a much more satisfactory clue as to results of novelties introduced in our markets, we recommend that small consignments should be sent in the first instance, the realisation of which through the hands of a respectable broker would furnish the merchant or grower with the actual value which they would realise in open market; the proceeds would show how far the article may be worth the exportation.

We are, dear sir, yours respectfully,
FORTNUM, MASON, & Co.

P. Le Neve Foster, Esq., Secretary of the Society of Arts.

EXAMINATIONS, 1858.

The following are the Papers set in the various subjects at the Society's Final Examinations, held in May last:—

ARITHMETIC.

THREE HOURS ALLOWED.

N.B.—The questions in this paper are arranged, as far as possible, in the order of difficulty, and it is not expected that any Candidate should solve more than one-half of them. The last eight questions are specially intended to test the knowledge of such persons as are desirous of gaining the highest class of Certificate.

1. Find the value of 581$\frac{5}{8}$ yards of cloth at 5s. 9d. per yard.

2. If 12 apples are worth 21 pears and 3 pears cost $\frac{1}{2}$d., what is the price of 70 apples?

3. If an army of 5,000 men could march 96 miles in 6 days of 8 hours each; in how many days of 5 hours each could an army of 1,500 men march the same distance?

4. If the 6d. loaf weigh 35 oz. when wheat is 37s. a load; what should the 7d. loaf weigh when wheat is 29s. per load?

5. If a tradesman use a false weight of 14$\frac{3}{4}$ oz. for a pound; how many pounds will 112 lbs. of just weight appear to be when weighed by his false weight?

6. Calculate the cost of 365 articles at 13s. 2$\frac{1}{2}$d. each article.

7. Find the value of 53 yds. 2 qrs. 3 nails at 5s. 10$\frac{1}{4}$d. per yard.

8. Distinguish between simple and compound interest. Find the difference between the simple and compound interest of £1,000 for 3 years at 5 per cent. per annum; also find how long £1,000 would be in amounting to £1,215 10s. 1$\frac{1}{2}$d. at the same rate, at compound interest.

9. Bought tea at 4s. 8d. per lb. How must I sell it to gain 12$\frac{1}{2}$ per cent.

10. A bankrupt owes his creditors £2,960 and can pay them 12s. 6d. per £1. How much would a person receive to whom he owes £641 18s. 4d.?

11. Show that 52 weekly payments (made at the end of each week) of £1 5s. each are equivalent to a single payment of £66 5s. 6d. at the end of the 52 weeks; interest at 4 per cent. per annum.

12. Explain the difference between banker's discount and true discount. Find both the banker's discount and the true discount on a bill of £250 for four months drawn on the 4th May and discounted 27th July. (The 3 days of grace are to be reckoned.)

13. What is the smallest number that contains an exact number of sevens, dozens, and scores?

14. Whether is the sum of $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{8}$, greater or less than $\frac{3}{4}$ of the sum of $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$, and $\frac{1}{9}$; and what is the difference?

15. *Prove* the rule for reducing a compound fraction to a simple one.

Example.—A cask of wine containing 162 gallons is divided among 7 persons, A, B, C, D, E, F, G, in the following manner: A has $\frac{1}{6}$ of the whole, B $\frac{1}{5}$ of what is left, C $\frac{1}{4}$ of the remainder, D $\frac{1}{3}$ of what C leaves, and the other three share the remainder equally among them. Find the number of gallons claimed by each person.

16. Explain the *reason* of the rule for the division of vulgar fractions, and divide the continual product of $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$, and $\frac{1}{9}$, by that of $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{8}$.

17. If 15$\frac{2}{3}$ grains of silver be worth 2$\frac{1}{4}$d., what is the worth of $\frac{5}{9}$ dwt.?

18. Add together the following decimals ·025, ·475, 3·01875, 4·0005. Reduce each of them to a vulgar fraction and add them together, and show that the two results coincide.

19. Divide ·0635 by ·0048, and multiply the result by 1·62.

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20. Explain the term "recurring decimal," and give any method or rule you know for reducing such a decimal to the form of a vulgar fraction. Also find the values of ·675 of £1, and of $\cdot07589\dot{2}8571\dot{4}$ of 1 cwt.

21. Express in the decimal notation £15 12s. 6d.; 16s. 4$\frac{1}{2}$d.; 7$\frac{3}{4}$d.; correctly to three places of decimals: and in common notation the following decimals of £1, ·89375, ·109375, $\cdot680208\dot{3}$.

22. Supposing a currency to be established of which the coinage consists of the pound or sovereign as the unit, the florin or $\frac{1}{10}$th of £1., the cent or $\frac{1}{100}$th of £1, the mil or $\frac{1}{1000}$th of £1. State the advantages of such a currency.

23. A cistern has 4 pipes; A will fill it in 24 minutes and B in 40 minutes, C will empty it in 48 minutes and D in 1 hour. They all run together, but B is closed after 16 minutes and D after 20 minutes; what time is required to fill the cistern?

24. If $\frac{4}{7}$ of an ounce of tea be worth $\frac{3}{8}$ of a lb. of sugar, and $\frac{1}{5}$ of a cwt. of sugar worth $\frac{2}{3}$ of a gallon of rum, and $\frac{10}{11}$ of a quart of rum worth 1s. 3$\frac{3}{4}$d. less than a pound of tea; what is the worth of 6$\frac{1}{2}$ lbs. of sugar?

25. Bought sugar at 10d. per lb. How must I sell it per lb. so as to gain as much on £100 as 4$\frac{2}{7}$ cwt. are sold for?

26. Suppose that in a town containing 10,560 inhabitants, 1 out of 33 dies annually and that there are 5 births for 4 deaths, the number of girls born being to that of boys as 7 : 9. How many boys and girls are born there annually?

27. Bought 63 dozen of sherry for £78 10s., and having retained a certain quantity for private use, I sold the remainder at £1 9s. 6d. per dozen, and thereby cleared £4 16s. 9d. over the reserve. What quantity did I retain?

BOOK-KEEPING BY DOUBLE ENTRY.

THREE HOURS ALLOWED.

1. State in general terms what are the objects sought to be attained by mercantile book-keeping.

2. What is the distinguishing feature or principle of the double entry method, as compared with that of single entry?

3. Does the double entry method necessarily prevent or detect every description of error or mistake in book-keeping?

Note.—The answer to this question is to be accompanied by reasons for it.

4. What are the principal books usually adopted in keeping accounts on the system of double entry?

5. What is the special use of the Journal?

6. What is the special use of the Ledger, and how is it formed?

7. What is a *Real* account intended to exhibit?

8. What is a *Personal* account intended to exhibit?

9. On which side of a Real account should the entry of property *received* be entered?

10. When cash is *paid* or goods (property) are *delivered* to any person, what account is to be debited and what account or accounts credited?

11. Write out the Journal entries in proper technical form of the following transactions:—

Purchased of Dombey and Son 50 Pipes of Wine for	£1,000
And of John Carker 10 Pipes of Wine for	300
Paid in Cash to Dombey and Son	350
Sold to Dombey and Son a Cargo of Staves for	600

12. Post to appropriate Ledger accounts the same transactions.

13. What is a Profit and Loss account intended to exhibit? and on which side thereof are gains and losses respectively entered?

14. What is the distinction between Gross Profit and Net Profit?

15. What is a Trial Balance? and what purpose is it intended to serve.

16. What should a Balance-sheet exhibit?

17. Work out the following supposititious facts and transactions by double entry through the Journal and and the Ledger, and draw out—firstly, a Trial Balance; and secondly, a Balance-sheet accompanied by a Profit and Loss Account.

On the 1st of January, 1858, Andrew Freeport began to trade with a capital of £2,000, consisting of—

Cash		£1,000
Bills receivable—		
due 30th of March	£200	
,, 28th of January	100	
		300
Wine		700
Total		£2,000

		£	s.	d.
Jan. 4th.	Sold to John Falstaff a Butt of Wine	150	0	0
9th.	Sold to William Honeycomb 3 Pipes of Wine	260	0	0
,,	Received from William Honeycomb his acceptance due 31st instant	250	0	0
	Abatement allowed (off sale of Wine to him	10	0	0
11th.	Bought of Dombey and Son 50 Pipes of Wine	1,000	0	0
12th.	Paid in Cash to Dombey & Son	350	0	0
14th.	Bought of James Thomson a Cargo of Staves	550	0	0
17th.	Sold to Dombey and Son the above Cargo of Staves	600	0	0
18th.	Accepted James Thomson's draft, payable 7 days after sight, due 28th instant	550	0	0
19th.	Sold to Philip Sidney 4 Pipes of Wine	280	0	0
20th.	Sold to John Dryden 6 Pipes of Wine	400	0	0
21st.	Received of Philip Sidney his acceptance due 28th Feb.	280	0	0
,,	Discounted William Honeycomb's acceptance for £250, due the 31st instant; received Cash	242	10	0
	Allowed Discount	7	10	0
22nd.	Bought of Dombey and Son 20 Pipes of Wine	340	0	0
,,	Accepted Dombey and Son's draft, due 25th March	200	0	0
	Paid to them, Cash	100	0	0
23rd.	Received from John Dryden, Cash on account	220	0	0
24th.	Sold to Alexander Pope 2 Pipes of Wine	120	0	0
,,	Bought of William Paley 60 Pipes of Wine	1,200	0	0
,,	Received Cash, for Bill Receivable on hand, 1st January, due this day	100	0	0
28th.	Paid Cash, acceptance in favour of James Thompson, due this day	550	0	0
29th.	Received Cash of Alexander Pope	40	0	0
,,	Sold to H. Bardolph, 10 Pipes of Wine	450	0	0
30th.	Received of H. Bardolph, Cash on account	200	0	0
,,	Bought, and paid for the same in Cash, 15 Pipes of Wine	600	0	0
,,	Paid Cash: Rent of Counting-house	7	0	0
,,	Ditto: Clerk's Salary	10	0	0
31st.	Interest on Capital accrued to this date: one month at 5 per cent. per annum on £2,000	8	6	8
,,	Drew out Cash for private purposes	100	0	0
,,	Stock of Wine on hand at this date	2,500	0	0

Note.—Candidates who reply to No. 17 need not reply to No. 9, No. 10, No. 11, nor No. 12; but "SATISFACTORY ANSWERING" in No. 17 will be deemed an indispensable condition of a "HIGH DEGREE OF EXCELLENCE."

ALGEBRA.

THREE HOURS ALLOWED.

The Candidates are recommended not to attempt any of the questions in the second portion of the paper, marbed B, until they have answered as completely as they can those in the first portion, marked A.

A.

1. Illustrate and explain the rule which is expressed by the formula, $-a\times -b=+ab$.

2. What is meant by the *Greatest Common Measure* of two algebraical quantities?

If R be the greatest common measure of two polynimials P and Q, it is also the greatest common measure of $P+Q$ and $P-Q$.

3. Find the Least Common Multiple of

$$a^3+2a^2b-ab^2-2b^3 \text{ and } a^3-2a^2b-ab^2+2b^3.$$

Also of a^2-b^2, $(a+b)^2$, and $a^2+ab-2b^2$.

4. Divide x^5+y^5 by $x+y$; and prove that x^n+y^n is always divisible by $x+y$, if n be an odd number.

5. Extract the cube root of

$$x^6-6x^5+21x^4-44x^3+63x^2-54x+27.$$

6. Reduce the following expressions to their simplest forms:

$$\frac{x^2-3x+2}{x^3-x^2-x-2};$$

$$\frac{1}{x-1}-\frac{x+1}{x^2+x+1}-\frac{x}{x^3-1};$$

$$\frac{1}{x}+\frac{x-5}{x(x+1)}+\frac{x^2+8}{x(x+1)(x+2)}.$$

7. Solve the following equations:

$$\frac{x-a}{x-b}+\frac{x-c}{x-d}=\frac{a}{b}+\frac{c}{d} \qquad (a)$$

$$(x-1)(x-2)+(x-2)(x-3)+(x-3)(x-1)=11 \qquad (\beta)$$

$$\left.\begin{aligned} x^2+xy+y^2&=7\\ xy-x^2&=1\end{aligned}\right\} \qquad (\gamma)$$

8. A ratio of greater inequality is increased by taking from both terms of the ratio any quantity which is less than each of those terms.

What quantity must be taken from each term of the ratio $a+b:a-b$, to increase it to three times its value?

9. There is a number consisting of two digits, and it is such that if the first digit be doubled it exceeds the second by unity, and that the difference of the squares of the digits is equal to the square of half their sum. Find the number.

Is there anything superfluous in this question?

10. When is one quantity said to *vary* as another? Give examples illustrative of your definition.

The space through which a heavy body falls from rest varies as the square of the time of falling; and in one second a body falls through 16.1 feet. Find the time in which a body will fall to the ground from the top of St. Paul's, the height being 404 feet.

B.

11. Reduce to its simplest form the expression:

$$\frac{a^2+bc}{(a-b)(a-c)}+\frac{b^2+ca}{(b-c)(b-a)}+\frac{c^2+ab}{(c-a)(c-b)};$$

and express the fraction $\frac{1}{x(x+1)(x+2)}$ as the sum of three fractions, having for their denominators x, $x+1$, and $x+2$ respectively.

12. Solve the following equations:

$$x^4+x^3+x^2+x+1=0 \quad (\alpha)$$
$$x^4+2x^3+x^2+2x+1=0 \quad (\beta)$$
$$x^3+y=y^3+x=1 \quad (\gamma)$$

13. There is a certain whole number, which being increased by the integral part of its square root becomes equal to 15. Find the number.

14. Distinguish between *Arithmetical* and *Symbolical* Algebra. Is the equation $a^m \times a^n = a^{m+n}$ assumed or proved? What is the meaning of the formula $a^0=1$?

15. A quadratic equation cannot have more than two roots.

In the equation $x^2-px-q=0$, if q be a positive quantity, what conclusion can you draw respecting the nature of the roots?

16. If $ax+by \propto z$, and $a'x^2+b'y^2 \propto z^2$, then

$$\frac{x^2}{y}+\frac{y^2}{x} \propto \frac{z^2}{x+y}.$$

17. The square root of a certain number consists of $2p+1$ digits; prove that if $p+1$ of them have been obtained by the ordinary process, the remaining p may be found by division only.

Can you enunciate an analogous proposition for the extraction of the cube root?

18. A man buys pigs, geese, and ducks. If the geese had cost a shilling a-piece less, one pig would have been worth as many geese as each goose is actually worth shillings. A goose is worth as much as four ducks, and twenty ducks are worth five shillings more than half a pig. Find the price of a pig, a goose, and a duck respectively.

19. *A* and *B* run a race of a mile. *A* gives *B* a start of *n* yards and beats him by *t* seconds. In the next race *A* gives *B* a start of t' seconds and is beaten by n' yards. In what time can *A* and *B* respectively run a mile?

20. If a be any quantity which satisfies the equation

$$x^n+x^{n-1}+x^{n-2}+ \dots +x^2+x+1=0,$$

then $a^{n+1}=1$.

GEOMETRY.

THREE HOURS ALLOWED.

SECTION I.

1. Upon the same base and upon the same side of it there cannot be two triangles which have their sides terminated in one extremity of the base equal to one another, and likewise the sides which are terminated in the other extremity. What principle in the practice of carpentry is an illustration of this proposition?

2. If a straight line be divided into two equal, and also into two unequal parts; the squares of the two unequal parts are together double of the square of half the line, and of the square of the line between the points of section.

3. Describe a square that shall be equal to a given rectilineal figure.

4. Two circles cannot touch one another in more than one point, or intersect one another in more than two points.

5. In equal circles the angles which stand upon equal circumferences are equal. Can the same straight line cut off similar segments of concentric circles?

6. Inscribe a circle in a given triangle; and also in a given Rhombus.

7. Describe a regular pentagon about a given circle.

8. The sides about the equal angles of equiangular triangles are proportionals.

9. If four straight lines be proportionals, the rectangle contained by the means is equal to the rectangle contained by the extremes.

10. Draw three straight lines which shall be in harmonic proportion.

11. If a straight line be at right angles to a plane, every plane which passes through it shall be at right angles to the plane.

12. If each of two solid angles be contained by three plane angles which are equal to one another, each to each, the planes in which the equal angles are have the same inclination to each other.

SECTION II.

1. If the opposite sides of a quadrilateral figure be equal to one another, the figure is a parallelogram.

2. Produce a line so that the rectangle of the whole line so produced and the original line shall be equal to a given square.

3. Upon a given straight line describe a triangle that shall be equal to a given rectilineal figure, and have one angle equal to a given rectilineal angle.

4. A B C is an isosceles triangle. In the base B C take any point D, the circle described through A, B, D, is equal to the circle described through A, C, D.

5. Through a given point without a circle draw a straight line which shall divide the circle into two segments—such that the difference of the angles they contain shall be equal to a given angle.

6. Investigate the conditions under which a quadrilateral figure which can be inscribed in a circle can also have a circle inscribed in it.

7. From the centre of the inscribed circle of an equilateral triangle, a circle is described with radius equal to half the side of the triangle. Show that the tangents to this circle from the three angles form a regular hexagon.

8. How would you proceed in order to show by actual superposition that the square of the hypothenuse of a right-angled triangle is equal to the sum of the squares on the sides?

9. If two spheres intersect, their common section is a circle.

10. The orthographic projection of a cube on a plane perpendicular to its diagonal is a regular hexagon.

11. If through a given point within a triangle, lines be drawn from the angles to the opposite sides, and the points of section be joined, the first three lines will be harmonically divided.

12. A person travelling along a straight line of rail, sees the sun's image reflected in a polished sphere. What is the path of the image on the sphere?

MENSURATION.

THREE HOURS ALLOWED.

1. Show how with a ruler and compasses to find the centre of a circle, and to describe a circle through three given points,

2. On an Ordnance Map of 6 inches to a mile the chord of a railway curve measures 4.654 inches, and its height $\frac{1}{2}$ an inch; what is the radius of the curve on the Map, and in reality?

3. If the chord of half the curve mentioned in the former question be 2·35 inches, what distance is lost by making the curve instead of going straight?

4. Two arcs of different circles are of the same length; they subtend angles of 15deg. 39m. 7sec., and 56deg. 9m. 43sec. respectively; the radius of one circle is 7·75 inches: what is the radius of the other?

5. The sides of a triangle are 7, 13, 18 feet; what is the area? What will be the area of a triangle whose sides are respectively double the above?

6. Find the area of a hexagonal field A, B, C, D, E, F, of which the sides reckoned from A are 26, 23, 18, 10, 16, 13, yards respectively, where the diagonal $AC=24$ yards, and the perpendicular from E falls upon the middle point of AC, and $=$ 8 yards.

7. What is the solid content of a frustum of a cone, the height of which is 1 foot 3 inches, and the diameters of its ends 2 feet, and 1 foot 8 inches, respectively?

8. Explain the Sliding or Carpenter's Rule.

9. A piece of timber is 12 feet 9 inches long, $\left\{\begin{array}{l}\text{1 foot 6 inches,}\\ \text{1 foot 3 inches,}\end{array}\right\}$ broad, and $\left\{\begin{array}{c}\text{1 foot } 4\frac{1}{2} \text{ inches,}\\ \text{9 inches,}\end{array}\right\}$ thick at the $\left\{\begin{array}{c}\text{larger}\\ \text{smaller}\end{array}\right\}$ end; what is its solid content?

10. Define the term *quarter girt*. And what would be the mean quarter girt of the above piece of timber?

11. What will be the cost of building a wall, with a triangular gable on it of 15 feet, the height of the wall being 48 feet, the breadth of it 42 feet 6 inches, and the thickness $5\frac{1}{2}$ bricks, at 36s. per rod, of $272\frac{1}{4}$ square feet?

12. How much plastering will there be in a room 15 feet long, 12 feet broad, and 9 feet 6 inches high, exclusive of skirting and cornice, there being two doors of 6 feet 3 inches by 2 feet 10 inches, and a window of 4 feet by 5 feet 3 inches? And what will be the cost at 5d. per square yard?

13. What will be the cost of the lead for a gutter down the two equal slopes of a roof, the height of which is $17\frac{1}{2}$ feet, and span 24 feet, at 3d. per lb., supposing each yard to contain 18 lbs.?

14. What would be the cost of glazing a triangular sky-light, the base of which is 12 feet 3 inches, and the height 5 feet 9 inches, at 1s. 4d., per square foot?

15. Show how to determine the content of a cask, considered as the middle zone of a sphere; and find the content in gallons when the diameters of the top and bottom are 4 feet 10 inches, and its height 4 feet 6 inches, inside measure.

16. Explain the term *specific gravity*. The sides of two cubes are as 3 : 4, their specific gravities as 2 : 3; compare their weights.

17. Two cubical boxes of oak, 5 inches in the side, outside measure, contain mercury and lead respectively; the thickness of the first box is 1 inch; what must be the approximate thickness of the other, in order that both may be of the same weight; the specific gravities of the substances being mercury 13·6, lead 11·325, oak ·925.

18. Explain accurately the principles of levelling, with the corrections for curvature and refraction, and the method by which the necessity for the latter is avoided.

19. From the following notes, plan and find the content of a field.

	to ⊙ C	
	3160	
	2438	960 D
B 1125	1050	
Begin	at ⊙ A	Range East.

20. Also the following:—

	to ⊙ D	
	490	
	260	75 E
G 100	188	
	Go to ⊙ F	
	to ⊙ G	
	420	
D 210	148	
	L of ⊙ C	
	to ⊙ C	
	475	
B 160	375	
	144	120 G
Begin	at ⊙ A	Range N

TRIGONOMETRY.

THREE HOURS ALLOWED.

1. Define sine, tangent, secant, degree; and explain the difference between a geographical degree and a trigonometrical degree.

2. Prove that $\sin A = \sin (180^\circ - A)$; $\cos A = -\cos (180^\circ - A)$; find the sine and tangent of 60°.

3. Prove the following equivalents:

(1.) $\sin (A + B) = \sin A \cos B + \sin B \cos A$.

(2.) $2 \cos A \cos B = \cos (A + B) + \cos (A - B)$.

(3.) $\tan (45^\circ + A) + \cos (45^\circ + A) = 2 \sec 2A$.

4. If $\sin B = m \sin (2A + B)$, prove that $\tan (A + B) = \frac{1-m}{1+m} \tan A$.

5. Prove that $4 \tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{239} = 45^\circ$.

6. Find the values that A admits of in the equation

$$\sin 4A + \cos 4A = \left(\frac{3}{2}\right)^{\frac{1}{2}}.$$

7. If a, b, c are the sides and A, B, C are the angles of a plane triangle, prove that

(1.) $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

(2.) $\cot A + \cot B + \cot C = \cot A \cot B \cot C + \operatorname{cosec} A \operatorname{cosec} B \operatorname{cosec} C$

(3.) $\tan \frac{A}{2} + \tan \frac{B}{2} = \frac{a+b-c}{a+b+c}$

8. Explain the ambiguous case in the solution of plane triangles.

9. Solve the following triangle:

$B = 39^\circ\ 15'$; $C = 45^\circ$; $AB = 100$; log cos $5^\circ\ 45' =$ 9·9978093; log sin $C =$ 9·8494850, and ·1483243 $=$ log 1·407.

10. Explain the process of solution with the help of logarithmic tables of a plane triangle when two sides and the included angle are given.

11. Define logarithm; logarithmic base: and state the convenience of taking 10 as the base for tabulated logarithms. What is the Napierian base, and what is its numerical value?

12. On what principle are the tables of differences and proportional parts formed? If log 72·754 $=$ 1·8618569 and log 727·53 $=$ 2·8618509, find the logarithm of ·7275392.

13. Define angle of a spherical triangle; and show that the sum of the angles of a spherical triangle is greater than two right angles, and less than six.

14. The sides of a spherical triangle being given, it is required to determine the cosines of the angles.

15. By what means can the formula for plane triangles be deduced from those for spherical triangles?

16. Enunciate Napier's rules for the circular parts of a

right-angled plane triangle; and prove that $\sin a = \sin c \sin A$; $\cos B = \cot c \tan a$.

17. Two angles and a side opposite to one of them are given in an oblique spherical triangle: show how to determine the other parts of the triangle.

18. Explain the method of calculating the angular distance of two given stars by means of the Theodolite.

CONIC SECTIONS.

THREE HOURS ALLOWED.

1. Define the (1) Ellipse, (2) Parabola, and (3) Hyperbola, as they arise from different sections of a cone: and hence show that particular species of (1) are a circle and a point; of (2) are two parallel straight lines and one straight line; of (3) are two intersecting straight lines.

2. Prove that the Latus rectum of a Parabola is four times the distance of the Focus from the Vertex; and that the Subnormal is half the Latus rectum.

3. A tangent is drawn to a Parabola at a point P, and intersects the tangent at the vertex in the point Y, and the diameter through the vertex in the point T; S is the focus; it is required to prove that SY is perpendicular to PT; and that $SP = ST$.

4. Show that the Parameter of any diameter of a Parabola is four times the distance of the origin of that diameter from the focus.

5. A Parabola being drawn on a plane, it is required to find its vertex, focus and directrix.

6. Define focus and eccentricity of an Ellipse; and determine the relation between the distance between the foci and the axes of the curve.

7. Prove that a tangent to an Ellipse at a given point cuts the major axis produced in a point whose distance from the centre is independent of the minor axis of the Ellipse.

8. Perpendiculars are drawn from the foci of an Ellipse on a tangent; prove that the distances of the points of intersection from the centre are equal to each other, and to the same major axis.

9. Define conjugate diameters of an Ellipse; and show that the sum of their squares is constant.

10. Draw a tangent to an Ellipse from a point (1) on it, (2) without it, by means of a ruler only.

11. Explain the elliptic compasses, or any other machine for a description of an Ellipse. How is a lathe ordinarily adapted to elliptic turnings?

12. By the method of proportions prove that:—
(1) The locus of the middle points of parallel chords of an Ellipse is a straight line.
(2) The area of the Ellipse $= \pi ab$.

13. Prove that in a Hyperbola the difference of the focal distances is equal to the transverse axis.

14. The tangents at the extremities of a focal chord of a Hyperbola intersect in the directrix.

15. Define the asymptotes of a Hyperbola; and if a strait line is drawn cutting the Hyperbola and its asymptotes; show that the intercepts between the curve and the asymptotes are equal.

16. Prove that the area of the triangle between the asymptotes of a Hyperbola and a tangent at any point is constant.

17. Show by the method of infinitesimals that an Ellipse is cut at right angles by a confocal Hyperbola.

18. A part of a conic curve is traced on a plane; determine to which of the three conic sections it belongs.

19. Two parallel tangents being drawn to an Ellipse, show that the rectangle contained by the parts of them intercepted between any other tangent and the points of contact is constant.

20. How many normals can generally be drawn to a Parabola from a given point? Find the locus of the point from which two, and no more than two, normals can be drawn.

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

One question to be answered in each Section.

(1)

1. Define the following lines of the Terrestrial Sphere, meridians, parallels of latitude, equator, rumb-line; and show that every section of a sphere by a plane is a circle. When does the rumb-line become a circle?

2. What is meant by "Plane sailing?" Is the difference of latitude found correctly from its principles?

3. Prove that the like parts of two parallels of latitude have the same ratio as the cosines of their latitudes.

(2)

1. Prove; Departure $\times$ Sec. middle latitude $=$ Difference of Longitude, and

$$\text{Tan. Course} = \frac{\text{Diff. Long.} \times \text{Cos. Mid. Lat.}}{\text{Diff. Lat.}}$$

2. What are "Meridional Parts?" What is the value of 1 second of latitude on Mercator's Chart in latitude 60 deg.?

3. What are the advantages of "Great circle sailing?" And what are the practical objections to it?

(3)

1. Investigate a method of finding the distance between two places on a great circle.

2. What is meant by the "Variation of the Compass?" And what is "Local deviation?" How are they allowed for on the compass course?

3. What is the distinction between the "Course from A to B" and the "Bearing of B from A?"

(4)

1. State the direction in which the wind turns in a Cyclone in the North Atlantic Ocean:—and the general track of these Cyclones.

2. Give a rule for finding the bearing of the centre of the Cyclone.

3. In a North Atlantic Cyclone progressing to the North-Eastward, state the successive shifts of wind experienced by a ship lying-to on the North side of the storm's track.

(5)

1. Explain the corrections which must be applied to the observed altitude of the Sun to obtain the true altitude. In what order should they be applied?

2. Define the sensible and rational horizons; and prove that the dip of the Sea-horizon varies with the square root of the height of the eye.

3. Investigate the expression for the augmentation of the Moon's semi-diameter.

(6)

1. Explain the method of finding the latitude of a place from the observed meridian altitude of a heavenly body.

2. Explain in a simple manner the principle of the method of finding the longitude by lunar observations. How may a chronometer be rated by Lunars?

3. When will an error in the observed altitude produce the least effect on the time deduced from it: and why?

(7)

1. Explain the principle of the sextant; and its principal adjustments.

2. What is meant by the "index error;" and how is it determined?

3. Make a sketch of the vernier and the adjacent divisions of the scale of a barometer when it reads 30·270 inches.

(8)

1. What is a "sidereal day?"—a "solar day?"—a "mean solar day?"

2. What is the difference between the sidereal *time* and apparent solar time? When do they agree?

3. Explain the contents of the column headed "Sidereal time" at page 11, for each month in the Nautical Almanack. Why is it sometimes called the "Right ascension of the mean sun?"

(9)

1. Investigate a formula for computing the altitude of the sun for a given Greenwich date.

2. Investigate a method of clearing the Lunar distance from the effects of parallax and refraction. Explain the correction for the spheroidal figure of the earth.

3. Investigate a method of finding the latitude from the altitudes of a celestial object near the meridian. Show how the "Hour-angles" are computed from "the times by chronometer" for the sun or a fixed star.

(10)

1. Investigate the formula for computing the meridional parts.

2. Show that the "meridional parts" corresponding to the latitude of the most eastward or westward point of a circular island are a mean between those of its most northward and southward points.

3. In a circle of a cyclone, at a given distance from its centre, show how to compute the difference between those parts of its circumference in which the winds are respectively easterly and westerly. And show from your formula that there is no easterly wind when the circumference passes through either pole.

Practical Questions.

To be answered in order.

1. A ship sails from latitude 50 deg. 21 min. N.; longitude 35 deg. 0 min. W. on the following true courses:—N.W. 25 miles, N.N.W. 33, and S.W. by W. 50, and W.S.W. 29, required her latitude and longitude.

2. On April 21st, 1858, the meridian altitude of Aldebaran = 31 deg. 18 min. 20 sec.: the star south of the Zenith, Index Correction — 0 min. 45 sec., and height of the eye above the sea 18 feet; required the latitude.

3. Required the Sun's amplitude at rising on June 18th, 1858, in latitude 51 deg. 28 min. N.

4. February 10th, 1858, at about 9h. 35m. p.m. mean time, in latitude 36 deg. 50 min. N., longitude by account 137 deg. 15 min. W., when a chronometer shewed 8h. 18m. 34s., the observed altitude of α Leonis was 42 deg. 36 min. 50 sec., index error — 2 min. 25 sec.; height of the eye 17 feet: required the longitude. On January 23rd at noon the chronometer was fast on G.M.T. 1h. 35m. 15s. gaining daily 2·5 seconds.

5. If on November 19th, 1858, the Sun be observed to have equal altitudes in the morning and afternoon at a place in latitude 42 deg. 52 min. S., and longitude 147 deg. 25 min. E., when a chronometer shows 10h. 49m. 23s. and 3h. 36m. 37s., required the error of the chronometer for mean time at the place at noon.

6. By the Nautical Almanac the distances of the Moon's centre from Pollux at 3h. and at 6h. mean Greenwich time, on Sept. 2nd, 1861, are 20 deg. 26 min. 37 sec. and 22 deg. 3 min. 3 sec., required the time when the distance is 21 deg. 30 min. 31 sec.

(*To be continued.*)

SCIENTIFIC CONGRESS AT CARLSRUHE.

The twenty-fourth meeting of the German Naturalists and Physicians is fixed to be held at Carlsruhe from the 16th to the 22nd of September next, under the presidency and direction of Messrs. Eisenlohr, Aulic Councillor and Professor of Physics at the Polytechnic School, and Bolzert, one of the Council of Physicians. It is expected that this meeting will take place under peculiarly favourable circumstances. Nearly all the noted philosophers of Germany have announced their intention of attending; Von Liebig, Bunsen, Argelander, Wöhler, Erman, Dove, Ettingshausen, &c.

SOUTH KENSINGTON MUSEUM.

During the week ending 10th July, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,697; on Monday and Tuesday (free evenings), 4,028. On the three Students' days (admission to the public 6d.), 972; one Students' evening, Wednesday, 106. Total, 8,803.

THE LONDON MECHANICS' INSTITUTION.

The following communication has been received from the Committee of this Institution:—

"The report of Dr. Lyon Playfair on the London Mechanics' Institution, ordered by the House of Commons to be printed (26th of March last), having thus been made public, and an able article thereon having appeared in *The Times*, followed by the notices of other journals, the Committee of Managers, after due consideration and examination of the various statements made, deem it but justice to the Institution and themselves to make a statement of facts to give the public a more entire and just view of the position of the Institution than would otherwise be obtained.

"The committee admit and deeply regret that the financial difficulties of the Institution have prevented it from continuing classes for instruction in many subjects of art and science, of great utility in themselves, but requiring competent and well-paid professors, and that the same cause has prevented the general character of its instruction being kept up to that standard of efficiency which they feel to be of the utmost importance, and and which the advancing spirit of the age imperatively demands. They are, however, fully sensible that, even without money difficulties, the Institution could not be expected to compete with the high standard of University and Collegiate institutions now offered to the public, probably in a large degree through the very influence and example of the London Mechanics' Institution.

"They believe, however, that it may be made a good preparatory school for such higher institutions to those who have not had preparation at other establishments, or for adults, who would not wish to enter a youthful assembly; and that hitherto it has met, and may meet, the wants of artisans, tradesmen, apprentices, clerks, and the numerous class of confidentially employed persons forming the great mass of the young men of London, who, unable to enter upon a thoroughly scholastic curriculum, may at a small expense pursue two or three branches of study, and thus secure at once the improvement of their minds, assistance in their business from the bearings of their study, and that advancement in social position which is almost inseparably connected with mental culture. These are useful occupations of time for evenings which otherwise might be spent in mere pleasure seeking, and cannot fail to mitigate the social evils which are now the objects of so much public attention.

"The committee also consider that while provision is made for such studies as require close and vigorous mental application, it is equally important that the wants of the large class whose daily avocations involve mental care and anxiety should be met by useful studies of a less severe kind—music, elocution, the various branches of drawing, &c. The same remark applies to the selection of lectures. The rule has been to secure four lectures in the departments of science, literature, and music, alternating through the quarter, and the most eminent literary and scientific men have been and are engaged for the lecture-hall.

"The committee can scarcely agree, nor do they think the public will agree with the opinion expressed in Dr. Playfair's report, that the classes of arithmetic, mathematics, book-keeping, chymistry, anatomy, landscape, architectural, and mechanical drawing, and human figure drawing, French, writing, and elocution, being all those

mentioned in the report except the music classes, 'show a proportion of light instruction to solid rarely to be found.' On the contrary, they are of opinion that these classes are eminently solid, and more useful to those for whom they are designed than more difficult subjects, implying greater previous attainments, at the same time admitting as they have done that many useful studies might be added but for the present low income of the Institute and its heavy debt.

"This building debt, being the expenses of fitting up and adapting a private house to the purposes of an Institution, and building a lecture theatre to hold 1,000 persons, was from the very commencement of the Institution £3,700; by the exertions of the committee of management it was reduced in 1842 to £2,350; interest for 3¼ years in arrear to 1846 added to the principal made the debt £2,655 10s.; since which time, owing to the heavy rental of £229 per annum, it has accumulated to its present amount of £3,398 18s. It will thus be seen that, so far from the debt having arisen from an annual increase of expenditure over income, it has scarcely increased from the foundation of the Institution to the present time, notwithstanding the annual payment of 4 per cent. interest in addition to the heavy rental. Had the Institution been free from debt at the outset, it follows that even at the end of the first 20 years the sum of £3,200, being the amount paid for interest alone, would have been added to its funds, and have prevented that injurious economy which has been the great cause of its decline, by actually precluding the carrying out of its legitimate objects.

"Among the causes which have led to the decline of this Institution, in common with others, the committee think the following entitled to consideration:—The extensive and continued alterations in the city and its neighbourhood, and the increased occupation of its houses for business only; the position of the Institution, which, although unrivalled as a central and quiet spot, eminently suited for studious pursuits, still lacks the attractions and external advantages of buildings fronting the great public thoroughfares; and, lastly, the competition arising from evening classes at colleges and Government institutions for conveying high class instruction at a small cost.

"Notwithstanding these, the value of the Institution (which the Committee even now believe to be the best of the kind in London) is unmistakeably shown by the large number of its members who come from great distances, many even from the outskirts of London, though other Institutions may be at their very door.

"With a declining exchequer, it is not matter for surprise that the number and efficiency of the classes should have been affected, and that the character of the Institution should not make that advance which the intelligence of the people demanded.

"The report, indeed, when stating the fact of the inadequate remuneration afforded by the Institution to its teachers, and of the various gratuitous services rendered, admits that classes cannot be maintained as vehicles of high class instruction unless the professors are properly paid, and a strong opinion is also expressed that that payment cannot be made out of the subscriptions of the members, who are supposed to belong to the industrial classes. No argument against the management can be fairly deduced from such a statement, which only furnishes a confirmation of the opinion entertained by the Committee as to the necessity of seeking extraneous aid, and does not shake their belief that they have secured the most efficient services at their command consistently with the state of the funds they have had to administer.

"The pressure of the great debt has, no doubt, operated to force a severe and ruinous economy into every department; the library, classes and teachers, the building and its repairs within, and the absence of commensurate publicity and educational enterprise without, all show the crushing effects of building outlay when deducted from members' subscriptions or income. In place of a noble institution of great power, we find, on close examination, grounds for surprise that students and teachers have so long struggled with inefficient support and accommodation.

"It is felt that the just course now to pursue is—first, to insure vigorous management within; secondly, to call for the aid of all who feel an interest in the prosperity of the Institution. The time has arrived when the institution, still resorted to by hundreds of persons, must, if it is to continue, be permanently placed on a sure footing, and if this is done, it will insure enlarged results—results honourable to the individuals and honourable to the city of the parent Mechanics' Institution.

"The committee are not without numerous testimonies to the usefulness of the institution, and if its doors should ever close, they cannot but believe that it has fulfilled its mission, and that the tens of thousands who have been its members show its influence to have been widely spread, and that it has borne no unimportant part in promoting the education of the people. They believe that it now possesses the elements of strength and adaptability to the wants of the age, and that it is only necessary to assist its funds to allow it to develop them; that its downfall would be a great loss to the community, and, in the language of *The Times*, be 'to the immense disgrace of the cause, to the great discouragement of science, and to the injury of the working classes;' that it is as easy with properly remunerated teachers, to have classes in which principles are taught, as those for mere practice, and that this is the element which must be at the base of all useful instruction. There is reason to believe, that with a removal of its debt and its heavy rental, it would be rendered efficient, and at the same time solvent; and the Committee appeal to all friends of education and kindred societies, to assist their exertions to secure the help of the Government to prevent the parent institution of England from closing."*

Home Correspondence.

SMALL PARCELS POST.

Sir,—There are very few persons engaged in business who will have any doubt of the importance and advantage of establishing a "Small Parcels Post," which is recommended in the Report published in the *Journal* of the Society on the 9th of July.

As a bookseller, sending some hundreds of parcels annually through the Post-office, I am practically acquainted with the peculiar advantages which it affords for the delivery of books in remote places in the three kingdoms, and also in the colonies; and on many occasions orders are given for single volumes to be sent in this way which would never be given at all but for this facility. The establishment of the Small Parcels Post will probably increase even the circulation of books, but it will confer a boon on most trades, which, without any just reason, has been hitherto confined to one. In cases where books are expensively bound, new books intended for presents, and others which require much wrappage and care in the transmission, they are often sent in parcels by railway, as in the conveyance by post, owing to the regulations for packing, a new book when posted becomes a second-hand one before it reaches the end of its journey, and bound books suffer still more. The Small Parcels

* As a proof of the vitality still remaining in the Institution, it may be observed that the members sent up by its Local Board of Examiners to compete for the certificates and prizes of the Society of Arts were remarkably successful, and that the proportion of certificates received by them to the members competing, was such as to secure for the Institution one out of the two prizes given by the Society to Local Boards.

Post will allow of parcels being securely packed; they need not, as now, be left open at the ends, and there will be no occasion at the Post-office to "inspect" them, by cutting off the wrapper, which appears to be the rule prescribed in doubtful cases.

But there is an important defect in the Post-office system in carrying parcels, which the public ought to insist upon having corrected. The railway companies are liable to the owner for the value of any parcel whilst it is *in transitu*,—why should not the Post-office be also liable? Although I have had but few books lost in their transmission through the post, I must add that, from whatever cause it is, I have never been able to recover one which had been so lost. There ought to be the opportunity given to the owners of identifying their property, and of recovering it without so much time being wasted, and so much trouble given, in the investigation, which generally ends in disappointment. The number of books constantly "in warehouse" at the Post-office, shows that in the details of business, on which, after all, no little of the good of any institution depends, there is a want of skill, of energy, or of power. I should propose, as a remedy for their safe transmission, a uniform rate of insurance on all parcels of one halfpenny or one penny up to a certain amount, the owner to have the right of recovery on proof of ownership and value; beyond this fixed value a per-centage insurance sufficient to cover risk; an insurance stamp to be affixed in all cases, before or on delivery to the Post-office agents. At present the Post-office is not liable for any loss. It is high time, however, to explode the popular notion that a registered letter containing property is *insured* by paying sixpence in exchange for the receipt of the Post-office agent. There is a good deal of red tape still in use at the General Post-office.

I am, &c.,
JOHN PETHERAM.

London, July 12, 1858.

SIR,—Highly appreciating the labours of the committee on the Small Parcels Post, I feel it important that every ray of information on this subject, and every suggestion occuring to individuals, should be furnished to the committee.

The advantage of such a means of conveying small parcels would be very great to me, if anything like security could be obtained for safe transmission, which experience convinces me does not exist in the present postal arrangements, for quite 10 per cent. of the parcels I have sent through the Post-office have been lost; this has induced me to send, where possible, through the small parcels conveyances; in them I have never lost a single parcel, although I have sent many times the number that I have sent through the post.

It is true that the Post-office offers an additional security in its system of registration, but the charge for registering is much too high for general adoption, as the cost of carriage must be borne by profits, which upon parcels of average value frequently do not exceed one shilling or one shilling and sixpence, and are very often much less. This I can illustrate in the case of two letters which I lost in June last. One contained a sample of metal of nominal value only, sent as a pattern to A, with an order; this was lost. The other, sent about the same time, contained silver to the value of 35s., sent to an artist, B, for work, for which his charge was 2s. 6d., with instructions to return it in A's parcel. This could not be done, as A, not having received the order, had not any parcel to send; therefore, B sent the silver by post, in which it was lost, he having paid sixpence, making, with the former charge, one shilling for postage, and if these two letters had been registered, that charge would have been doubled, while the whole possible profit arising for the work performed was two shillings and sixpence.

This great obstacle to the transmission of parcels by post I think might be removed by a more moderate charge for registration, or by an equitable insurance, which is an important consideration, for the usefulness of the Parcels Post will be limited by the amount of the charges, while the success of the scheme must wholly depend upon the extent of its use by the public.

I am, &c., E. NASH.

30, Coppice-row, E.C., July 13, 1858.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 6th July, 1858.

98 (a4). Poor-rates and Pauperism—Return (A).
376. Endowed Schools (Ireland)—Return.
261 (1). Colonization, &c. (India)—Map.
137. Bills—New Trial in Criminal Cases.
169. ——— Titles to Land (Scotland) (Amended).
178. ——— Government of India (No. 3) (Amended).
Ordnance Survey Commission—Report.

Delivered on 7th July, 1858.

382. East India (Transport of Troops)—Report from Committee.
386. Education (Ireland)—Copies of Report, &c., relating to J. W. Kavanagh, Esq.
379. Bills—Universities (Scotland) (as amended in Committee, on Re-commitment, and on consideration of Bill, as Amended).
181. ——— Legitimacy Declaration (Amended).

Delivered on 8th July, 1858.

363. Billeting System—Report from Committee.
375. Coals (Woolwich and Portsmouth)—Return.
180. Bill—Sale and Transfer of Land (Ireland) (as amended in Committee and on Re-commitment).
Discovery of Gold (Frazer's River District)—Correspondence.

Delivered on 9th July, 1858.

365. Fire Insurances—Return.
399. Mines under the Sea (Cornwall)—Papers.
400. Wellington Monument—Copy of Report.
388. St. Helena and Hong Kong—Return.
182. Bills—Endowed Schools Law Amendment.
186. ——— Bishops Trusts Substitution (amended).
Railways of the United States—Supplement to Capt. Galton's Report.

Delivered on 10th and 12th July, 1858.

393. Gas (Metropolis)—Report from Committee.
402. Public Income and Expenditure (year ended 30th June, 1858)—Account.
162 (7). Civil Services—Estimates (Class 7).
347. Ramsgate Harbour—Abstract of Accounts.
384. Metropolitan Police—Return.
392. East India (Administration of Justice)—Return.
389. German Emigration (Cape of Good Hope)—Return.
352. Loans (Public Works)—Return.
187. Bills—Municipal Franchise (Lords Amendments).
192. ——— Railway Cheap Trains.
188. ——— Local Government (as amended in Committee and on Re-commitment).
189. ——— New Writs.
190. ——— Rateable Property (Ireland).
191. ——— Gaols and Houses of Correction Act Amendment.
Netley Hospital—Report of the Site, &c.

Delivered on 13th July, 1858.

356. Forgery, &c.—Return.
364. Metropolitan Turnpike Trusts—Return.
370. Ordnance Survey—Map.
406. Bothnia—Return.
344. Harbour of Refuge—Report and Evidence.
187. Bills—Municipal Franchise (Lords Amendments) (a corrected Copy).
193. ——— Chinese Passenger Act (1855) Amendment.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette*, *July* 9, 1858.]

Dated 4th March, 1858.

430. W. Wilkinson, Bayswater—Imp. in machinery and apparatuses for spinning threads, for preparing threads, for weaving and knitting, for covering cores with fibrous and other materials, and for making ropes, parts of which are applicable as pulleys, reels, and bobbins.

Dated 10th April, 1858.

776. J. Oxley, Beverley, Yorkshire—Certain imp. in the doors and sashes of carriages.

Dated 15th June, 1858.

1350. B. Pitt, 4, Great Carter-lane, Doctors'-commons—Imp. in the construction of knobs and roses used with locks, latches, and such like fastenings as are constructed with spindles.

1352. Baron F. Julius, Wedel-Jarlsberg, Frederikswœrn, Norway—An improved self-registering compass or control compass.

1354. Sir F. C. Knowles, Bart., Lovel-hill, Berkshire—Imp. in the fabrication or manufacture of steel.

1356. A. Dembinsky, Islington, and A. C. Engert, City-road—An improved fire-proof composition or wash.

Dated 16th June, 1858.

1358. B. Predavalle, 470, New Oxford-street, Bloomsbury—Imp. in the mode of obtaining motive power.

1362. W. Sawney, Beverley—Imp. in apparatus applicable to screening, winnowing, and corn-dressing machines.

1364. J. H. Dickson, Stanley-terrace, Rotherhithe—Imp. in machinery or apparatus for scutching and hackling flax, hemp, and other similar fibrous materials.

1366. J. Westwood, London-yard, Isle of Dogs, Poplar—Imp. in the construction of iron ships.

1368. T. Steven, Glasgow—Imp. in making moulds for casting.

Dated 17th June, 1858.

1370. F. Walton, Wolverhampton—A new or improved manufacture of japanned wares.

1372. J. Allardice, Glasgow, and W. Miller, Blantyre, Lanark, N.B.—Imp. in gasaliers.

1374. G. Hale, Tavistock-street, Covent-garden—Improved apparatus for obtaining motive power.

1376. C. Crockford, Holywell, Flintshire—Imp. in the treatment of the ores of zinc, and in spelter making.

Dated 18th June, 1858.

1378. J. Shaw, Cheapside, Leicester—Imp. in fire-arms.

1380. W. Spence, 50, Chancery-lane—Imp. in clogs, shoes, or supports for the feet. (A com.)

Dated 19th June, 1858.

1382. F. G. Spilsbury, Dresden, Saxony—Making tungstic acid and certain of its salts, and for using the same to decolour acetic acid and its compounds.

1386. R. Winans and T. Winans, Baltimore, U.S.—A new and useful imp. in the form of the hulls of steam vessels.

1388. R. Winans and T. Winans, Baltimore, U.S.—A new and useful imp. in ocean steamers.

1390. R. Halldon, Willenhall, Staffordshire—Certain imp. connected with engines worked by steam or atmospheric power.

Dated 21st June, 1858.

1392. Sir J. C. Anderson, Bart., Fermoy—Imp. in locomotion, parts of which are applicable for other purposes.

1394. R. A. Brooman, 166, Fleet-street—Imp. in steam cocks. (A com.)

1396. J. Lawder, Lieut. and Brevet Capt. in the Honourable the East India Company's Army—A method of supporting or carrying knapsacks, packs, and other weights on the back.

1398. W. C. Wilkins, Long Acre—Imp. in lamps.

1400. W. E. Newton, 66, Chancery-lane—An improved method of effecting the separation of the fibres of wood for the manufacture of paper therefrom, which is also applicable to the separation of the fibres of flax or other substances, for the manufacture of textile fabrics, and also to the separation of other substances for similar or other purposes. (A com.)

1402. W. E. Newton, 66, Chancery-lane—Imp. in the process and machinery for obtaining from waste and refuse felted fabrics of wool, fur, or other materials, fibres in a suitable condition for being worked into felt and other fabrics. (A com.)

1404. H. Deacon, Widnes Dock, near Warrington, Lancashire—Imp. in purifying alkaline lees.

Dated 22nd June, 1858.

1406. G. Schaub, Birmingham—Imp. in the manufacture of door plates, sign-boards, and other surfaces, having inscriptions, designs, or ornaments thereon, and in the manufacture of detached letters, designs, and ornaments to be affixed to walls and sign-boards, or used for other like purposes.

1408. J. Pym, Trinity-square, Surrey—Imp. in machinery for felling trees.

1410. W. E. Kenworthy, Water-lane, Leeds—Imp. in manufacture of steel.

1412. E. Cockey, H. Cockey, and F. C. Cockey, Frome, Somerset—Imp. in apparatus employed in the manufacture of cheese.

Dated 23rd June, 1858.

1414. S. Barlow, Stakehill, near Middleton, Lancashire—Imp. in machinery or apparatus for bleaching or cleansing textile fabrics or materials.

1416. C. Vero and James Everitt, Atherstone, Warwickshire—Imp. in the manufacture of hats.

1418. W. Clibran and J. Clibran, Manchester—Imp. in apparatus or arrangements for distributing, governing the pressure of, and lighting gas.

1420. Sir J. Paxton, M.P., Rock Hill, Sydenham—Imp. in the manufacture of horticultural buildings or glazed structures for horticultural and other purposes.

1422. W. E. Newton, 66, Chancery-lane—Certain imps. in centrifugal governors for steam engines and other motors. (A com.)

Dated 24th June, 1858.

1423. C. Bordas, 8, Upper Stamford-street, Blackfriars-road—Imp. in the mode or method of producing embroidery.

1424. J. Bates and J. York, Hyde, Chester, and W. Parkin, Sheffield—Imps. in pistons and plungers.

1426. G. Collier, Halifax—Imp. in means or apparatus for the stretching and drying of woven fabrics.

1428. W. E. Newton, 66, Chancery-lane—Improved machinery for manufacturing friction matches. (A com.)

Dated 25th June, 1858.

1432. J. Betts, Strand—Imp. in obtaining surfaces on which to print maps and other designs.

1434. T. Booth, Rahere-street, Goswell-road—Imp. in mounting and fitting wheels and axles to carriages, which imps. are also applicable to pullies and other parts moving on axes.

1436. J. Maudslay, Lambeth—An imp. in the construction of furnaces for melting iron, steel, and other metals.

1438. J. Taylor, Swanton Novers, Thetford, Norfolk—An imp. in the construction of horse-hoes, applicable also to drills.

Dated 26th June, 1858.

1442. S. Whitehall, Jacquard Works, Huskinson-street, Nottingham—Certain imp. in finishing lace and other fabrics.

1444. J. A. Manning, Inner Temple—An improved mode of intercepting and treating the sewage of London, and town and cities similarly situated.

1446. D. Campbell, Wemyss Castle, Kirkaldy, Fifeshire—A new grubbing and harrowing land roller.

1448. E. E. D'Heurle, Paris—Imp. in boxes for keeping and measuring coffee, tea, and other substances requiring to be preserved from contact of the air.

1450. C. Erhard, 7, Rue des Navarin, Paris—Imp. in apparatus for boring wells. (A com.)

Inventions with Complete Specifications Filed.

1431. C. W. Cahoon, Maine, U.S.—An improved machine for sowing seed or fertilizing material or other substances broad-cast.—24th June, 1858.

1440. T. Lemon, Duke street, Cardiff—Improving Cartwright's original patent chain harrow.—26th June, 1858.

WEEKLY LIST OF PATENTS SEALED.

July 9th.

44. T. Knowles & W. Ogilvie.
45. I. Taylor.
54. E. B. Bright.
56. W. Parsons.
57. C. E. Matson.
66. J. Varley.
85. W. Waller.
97. W. Muir.
103. W. Conisbee.
104. P. Robertson.
114. W. Clark.
121. A. Sterry.
136. J. Garnett and P. Garnett.
149. J. W. Midgley.
152. P. Bussi.
165. R. Weare.
255. L. Cass.
660. W. Chadwick.
956. R. Johanny.
978. L. Talabot.
998. T. Preston.
1059. G. Lowry.
1086. S. Carpenter.

July 13th.

51. C. Barlow.
52. G. W. Muir.
53. R. A. Brooman.
63. J. Stenson.
64. H. Ingle.
67. C. Schinz.
76. E. Hills.
80. R. A. Brooman.
82. A. Walker and T. Walker.
94. C. N. Nixon.
113. J. S. Brown.
162. J. Elder.
209. G. Bertram & W. McNiven.
239. W. Prown and C. N. May.
278. E. D. Johnson.
577. D. Harris.
844. C. Hawker.
960. E. Derogy.
1078. R. Hislop, junr.
1081. A. Wolff.
1149. A. P. Price.

Patents on which the Stamp Duty of £50 has been Paid.

July 5th.

1516. J. A. Bellay.
1518. A. H. A. Durant.

July 6th.

1603. H. S. Boase.
1612. J. Reilly.
1773. E. Hall.

July 8th.

1548. J. Wilson.

July 9th.

1547. J. H. Nalder.
1552. T. W. G. Treeby.
1561. E. D. Chattaway.
1562. J. Caldow and J. B. A. McKinnell.

July 10th.

1555. C. F. Bielefeld.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4103	June 28.	Bowman's double action Travelling Blocks, for facilitating the removal of an under tier of casks	J. Bowman	15, Shaw's Brow, Liverpool.
4104	July 7.	An Improved Washing Machine	J. Cowley	Parks, St. Giles, Oxford.
4105	„ 9.	Spade or Shovel	Smith and England	Stourbridge.
4106	„ 10.	Improved Cork Bottle Stopper	T. H. Rees and J. D. Sprague	54, Union-street, Southwark.

Journal of the Society of Arts.

FRIDAY, JULY 23, 1858.

NOTICE TO INSTITUTIONS.

In accordance with the resolution passed at the last Annual General Meeting of the Society, the Council will present to each Institution in Union a quarto copy of the Speeches and Addresses of H.R.H. the Prince Consort.

The Department of Science and Art have placed in the hands of the Council a number of copies of the "Introductory Addresses on the Science and Art Department and the South Kensington Museum," delivered there during the last session, and a copy of this work will also be presented to every Institution in Union.

In addition to the above, the Council have decided to present to each Institution copies of twenty-two lectures delivered before the Society of Arts, on the results of the Great Exhibition of 1851.

Institutions desiring copies of these works are requested either to apply for them at the Society's House, or to communicate to the Secretary of the Society of Arts the address of an agent in London to whom they may be sent.

SPECIAL PRIZE.

The Prize of Twenty Pounds (placed at the disposal of the Council of the Society of Arts for this purpose, by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., will be awarded according to the following conditions:—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breadth must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*—It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

Competitors are desired to take notice that the Council reserve to themselves the right of withholding the prize should there be no article of sufficient merit brought under their notice.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 1st of January, 1859.

EXAMINATIONS, 1858.

The following papers, set at the Society's Final Examinations, in May last, are continued from page 545.

STATICS, DYNAMICS, AND HYDROSTATICS.

THREE HOURS ALLOWED.

N.B.—In the first section of this Paper, answer only *one* of the questions under each number, *either* A *or* B; in the second section you may answer all or any of the questions.

SECTION I.

1. (A) Show how the resultant of any number of forces, acting upon a given point in the same plane, may be determined.

(B) Apply the Principles of the Composition and Resolution of Forces to explain the action of the chains of a suspension bridge.

2. (A) Give a general description of the construction and mode of using Atwood's machine.

(B) Give a Tabular Analysis of the Motion of a Falling Body, carried to five seconds of time.

3. (A) Define the term "Line of Direction," and show that a Cone will stand more firmly on its base than a Cylinder of equal dimensions.

(B) Why is it necessary to lean forward before rising from a Chair?

4. (A) Prove the equation of equilibrium in the Wheel and Axle, and the Screw.

(B) If in a Differential Screw the thread of the outer screw be $\frac{3}{4}$ inch, and that of the inner $\frac{1}{2}$ inch, the length of the lever 2 feet 6 inches, and the power applied 45 lbs., what compressing force will be exerted?

5. (A) State the general Laws of Impact and Collision; and explain the principle upon which the efficacy of the Hammer depends.

(B) Enumerate the principal Machines, and their uses, which depend upon Impact for their power.

6. (A) What is the Hydrostatic Paradox? Describe an apparatus for illustrating the nature of this principle.

(B) Show, by reference to the apparatus called the Hydrostatic Bellows, that the Hydrostatic Paradox is analogous to the principle of "Virtual Velocities" in Mechanics.

7. (A) Show by a diagram the construction of Bramah's Hydrostatic Press; and explain the mode adopted in applying its power to launch the great steam ship "Leviathan."

(B) Explain the principle of the Equality of Pressure of Fluids, and describe its application by a diagram of the Water-crane.

8. (A) A solid immersed in a fluid loses so much of its weight as is equal to the weight of the fluid it displaces; explain the method of verifying this fact experimentally.

(B) Define the meta-centre, and show its relation to the conditions of stable, unstable, and neutral equilibrium in floating bodies.

9. (A) Define the meaning of the term "Specific Gravity." What are the uses and modes of employing the Hydrometer and the Specific Gravity Bottle?

(B) Explain the mode of obtaining the Specific Gravity of a solid substance lighter than water; and apply it to determine the Specific Gravity of a light substance from the following data:—

Weight in air	50 grains.
Weight of piece of Metal in Air	388 grains.
Weight of both in Water	342·2 grains.
Weight of Metal in Water	343·8 grains.

10. (A) Describe any two of the machines which have been used for raising water independently of Atmospheric Pressure.

(B) Explain the construction and the action of the valves of the Lifting and Forcing Pumps respectively.

11. (A) Upon what circumstance does the velocity of a fluid, issuing from an aperture in a vessel, depend? If a tall vessel be pierced with holes at the depth of 1, 4, 9, 16, 25, inches, what will be the respective velocities of the issuing fluid?

(B) What is the Vena Contracta? Explain the cause of this phenomenon, and describe the arrangements by which the greatest quantity of a fluid can be discharged by an aperture of given dimensions at a given depth.

Section II.

1. Describe Smeaton's Pulley, and explain, by a diagram, the system of pulleys in which the equation of equilibrium is

$$P = \frac{W}{2^n}$$

2. Define and explain respectively the Centres of Oscillation, Percussion, and Gyration.

3. Explain the Law of the Descent of a Body upon an Inclined Plane; and find the Velocity of a body when it has moved through 150 feet on a perfectly smooth plane, inclined to the horizon at an angle of 30°.

4. Show that the surface of a fluid at rest is perpendicular to the resultant of all the forces which act at any point of the surface.

5. A portion of freestone weighs in air 1871·7 grains, and in water 1042·76 grains, a portion of marble weighs in air 1087·4 grains, and in water 635·37 grains; compare the densities of the two stones.

6. Water flows from a horizontal jet 10 feet from the ground, in the side of a cylindrical vessel, with a velocity of 4 feet per second; at what distance from the bottom of the vessel will the jet strike the ground?

7. What are the most effective arrangements for the Centrifugal Pump? What proportion of the power can be utilised?

8. Describe the principle and construction of Mongolfier's Hydraulic Ram.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

1. What is friction? State the principal laws which regulate its action. Explain some of the means adopted to reduce the friction between an axle and its bearing in machinery.

2. Describe the Hydrostatic Press; explain the principle of its action, and show particularly the method of preventing leakage between the ram and the cylinder.

3. What are the laws which govern the motion of a pendulum? Explain the Dead-Beat Escapement in a clock.

4. What is the object of the fusee in a watch? How is a watch kept going while being wound up?

5. Distinguish between cast iron, malleable iron, and steel.

6. Describe the construction of a Cornish Boiler. What are its principal appendages?

7. Having given the strength of boiler plate per square inch of section, show how to find the thickness of a cylindrical boiler of given diameter, adapted to support a given pressure of steam.

8. Give an account of the principal parts of a condensing Beam Engine.

9. Explain the "Parallel Motion" of a Beam Engine.

10. What is meant by the "lap" and "lead" of a slide valve? In what way do they affect the working of a Steam Engine?

11. How may the Horse Power of a Steam Engine be determined?

12. Explain the advantage of working a Steam Engine expansively. What is the arrangement of Woolf's Engine?

13. Describe Mr. Whitworth's Planing Machine?

14. Give any methods of advancing the Drill in Drilling Machines.

ELECTRICITY AND MAGNETISM.

THREE HOURS ALLOWED.

1. What are the poles of a magnet, and what are their properties?

2. What is inclination or dip? Describe the instrument by which it is observed, and its present amount.

3. How is the compass affected by the iron of a ship? and how can this disturbance be best obviated? Is the effect constant?

4. Can magnetism be properly called an attractive force? Illustrate your answer by experiment.

5. What are the three elements of terrestrial magnetic force? How have their changes been observed and recorded.

6. How many kinds of electricity are there? By what means is their existence recognised?

7. What is the difference between an electroscope and an electrometer? Describe Coulomb's torsion electrometer.

8. Is the *contact* of an electrified body necessary for the disturbance of electrical equilibrium in another body? What is this mode of action called? Describe some illustrative experiment or apparatus.

9. What are the actions respectively of a point and a knob when presented to an electrified body? Explain the theory of this.

10. What conditions are essential to the efficacy of a lightning conductor?

11. Describe Wollaston's and Smee's Batteries, and their relative advantages or disadvantages.

12. Describe some simple cases of elecrolysis by a battery current, and the actions which take place in the battery.

13. By what means can electricity of high tension be obtained through the agency of a battery current.

14. Describe the magneto-electric telegraph, and state its advantages and disadvantages.

15. Describe the construction and uses of a thermo-electric pile.

HEAT.

1. Explain the nature of heat.

2. What is the principle of construction, and the mode of graduating a thermometer.

3. Describe the modes by which heat may be transmitted from one body to another.

4. Explain the principle involved in the selection of materials for clothing.

5. What is the specific heat of bodies? Illustrate your answer by experiments.

6. Under what circumstances does heat become latent? Give a conspicuous example of the amount of latent heat.

7. Show by an experiment that the reflection of light and of heat are analogous.

8. Explain the relations between surface and radiation.

9. State the phenomena of evaporation; and the construction of the *cryophorus*.

ASTRONOMY.

THREE HOURS ALLOWED.

1. Define the terms "Equator," "Ecliptic," "Tropics," "Polar circles," "Right Ascension," "Declination," "Meridian," "Terrestrial latitude and longitude," and "Celestial latitude and longitude."

2. Describe the Ptolemaic and Copernican systems, and state your reasons for preferring one to the other.

3. Explain the length of days and seasons at different parts of the earth.

4. Describe the Transit instrument and its use.

5. Explain the principle of Hadley's sextant.

6. Explain the equation of time.
7. Describe any physical peculiarities in the Moon.
8. What is the method of finding the time by equal altitudes?
9. The Sun's meridian altitude being observed and his declination given, to find the latitude of the place of observation.
10. Describe any physical characters of the fixed stars, milky way, and nebulæ.
11. State the laws of Kepler.
12. Describe any methods of determining the figure of the Earth.
13. Explain the Trade Winds.
14. State the law of Gravitation and its application to motion in an orbit.
15. Explain the precession of equinoxes and its physical cause.
16. State any proofs of the rotation of the earth.
17. Describe the different aspects of the ring of Saturn as seen from the Earth, and the reason of them.
18. Explain any method of determining the distance of a planet from the Sun.
19. Give a general explanation of the Tides.
20. Explain how Venus has two summers and two winters in her year.

CHEMISTRY.

THREE HOURS ALLOWED.

No Candidate is to answer more than three questions in each Division.

First Division.

1. What is meant by the expression "coefficient of expansion of gases?" Give numerical instances.
2. Describe the action of heat upon water in its different states.
3. A piece of stone weighs three pounds in the air, but only two pounds when immersed in water; what is its specific gravity?
4. Describe the decomposing action of light on chemical compounds, adducing instances.
5. Describe the construction of a Daniell's cell. Explain its action, and the changes which occur during its action.
6. How are metallic objects silvered or gilt by the action of galvanism?

Second Division.

1. How is atmospheric air best analyzed? And how are its chief constituents best prepared in a state of purity?
2. How much oxygen will be necessary for the complete combustion of a gallon of marsh gas?
3. Describe the preparation of nitric acid; also its best reactions.
4. Explain the manufacture of sulphuric acid; its uses, impurities, and reactions.
5. What are the constituents of coal gas, and how are they severally detected in that mixture.
6. By what processes can the amount of nitrogen be determined in organic bodies?

Third Division.

1. How is metallic tin prepared? How purified? Describe its chief uses.
2. A solution containing free hydrochloric acid gives a black precipitate with sulphuretted hydrogen. What may this precipitate consist of? and how would you examine it?
3. Explain the manufacture of cast-iron, wrought-iron, and steel.
4. A mixture is given containing common phosphoric acid, sulphuric acid, magnesia, and soda, dissolved in water. How would you separate these constituents and estimate them quantitatively?
5. How much silver is contained in 100 grains of the chloride?
6. Describe the manufacture of soda-ash; name its chief impurities, and explain how their percentage is estimated?

Fourth Division.

1. Describe the preparation of acetic acid; also the composition and properties of its chief compounds.
2. 100 grains of a volatile organic body yielded in combustion

193,3. gr. carbonic acid;
81,5. gr. water;

calculate the empyrical formula of the body.
3. How is the atomic weight of tartaric acid determined?
4. Describe the preparation, properties, and chief compounds of quina.
5. How is butyric acid prepared from sugar?
6. Explain the action of anhydrous sulphuric acid on olefiant gas; also the action of hydrated sulphuric acid.

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

N.B.—The candidate may choose such questions from this paper as he judges he can satisfactorily answer within the time allowed; it being understood that value will be given for the fulness as well as the number of the answers, provided they are to the point.

1. Explain what is meant by a "vital property." What vital properties are recognised in the animal body, and by what phenomena do they manifest themselves?
2. Give a short account of the blood; comprehending its physical characters and chemical constitution—its corpuscles, with their differences in figure, size, and structure in different animals—the nature of the plasma, and the changes which take place in blood drawn from the vessels.
3. Point out the differences of animals and vegetables in respect of the nature of their food and mode of nutrition. Mention the chief alimentary principles contained in human food, and explain the purposes which they respectively fulfil.
4. Give a concise description of the several parts of the alimentary canal in Man, and state the chief modifications, connected with the nature of the food, which it presents in different animals. Describe more particularly the structure of the stomach in ruminating animals, and explain the process of rumination.
5. Give an outline of the structure of the chest and lungs, and explain the mechanism of breathing; state the changes which the air and blood respectively undergo in respiration, the purposes fulfilled by that function in the animal economy, and the train of consequences which follow its suppression.
6. What explanation can be given of the process of secretion? Describe the mode of construction of secreting organs in general, with the modifications of the general type in the different classes of these organs; pointing out the adaptation of structure to function, so far as it is understood.
7. Describe succinctly the structure of the human ear, and state what appear to be the most probable uses of its several parts; referring to the modifications presented by the organ in the animal series, so far as they appear to throw light on its functions.
8. Give an outline of the structure and general arrangement of the nervous system in a vertebrated animal, and compare it with that of the articulata. State briefly the functions of the nervous system.
9. State the chief points of difference between mammiferous animals and batrachian reptiles, in respect of their general economy, their principal organs and functions, and the mode of their fœtal development.
10. Explain the principle of *homology* as manifested in the construction of the vertebrate skeleton; giving examples in illustration.

BOTANY.

THREE HOURS ALLOWED.

The Candidate is not to answer more than twelve questions, which may be selected at will from the two Sections.

Section I. (for Competency.)

1. Enumerate the organs found on a perfect flowering plant.
2. Describe the most important kinds of venation of leaves.
3. Name the principal forms of inflorescence.
4. Explain the difference of structure between a double Rose and a double Dahlia.
5. Name and give examples of the different relations in which the calyx and ovary stand in flowering plants.
6. What differences do we find in the structure of the seeds of the Oat, Bean, and Linseed?
7. By what characters can you distinguish Hemlock (*conium maculatum*) from any other native plant?
8. Give a short character of the order Cruciferæ.
9. Give a short character of the order Leguminosæ.
10. How do you know Malvaceæ from any other native plants?
11. Refer the following plants to their respective natural orders:—Strawberry, Sweet-pea, Fuchsia, Monkshood, Tulip, Crocus, China Aster, Thyme, and Celery.
12. State what you know of the functions of the different organs of flowering plants.

Section II. (for Proficiency or Excellence.)

1. Explain the morphological connection of the organs of flowering plants.
2. State the general rules upon which the classification of the forms of leaves is founded.
3. Explain the relations of the different forms of the indefinite type of inflorescence.
4. Give an outline of the general principles of the morphology of flowers.
5. Describe and explain the various conditions of the calyx and ovary in the Rosaceæ, (including the Pomeæ and Amygdaleæ.)
6. Describe minutely the ovule and ripe seed of any plant with which you are acquainted.
7. Mention and give the essential characters of the poisonous Solanaceæ found wild in Britain.
8. Name an order which has the following character:—sepals, petals, and stamens 4—8 or 5—10, corolla monopetalous, stamens hypogynous, anthers opening by pores, ovary superior, many-celled, many-seeded.
9. Name an order which has sepals and petals four or five, stamens indefinite, inserted on the calyx, ovaries composed of more or less distinct carpels more or less superior or inferior.
10. State the differences between Linaceæ, Malvaceæ, and Geraniaceæ.
11. Name the native plants cultivated for food belonging to the orders:—Cruciferæ, Umbelliferæ, Rosaceæ, Compositæ and Liliaceæ.
12. Give a brief outline of the principal chemical and physiological phenomena occurring in the growth of ordinary green plants.

AGRICULTURE.

[No paper was set in this subject, as no candidates appeared in it this year.]

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

Each of the four following questions should be answered.

1. Show the way in which the division of labour increases the productive powers of man.
2. What is fixed Capital? and what is circulating Capital? and of what does each consist?
3. Define Rent, Interest, and Profit.
4. Describe a Bill of Exchange and its origin.

The four following are optional Questions.

1. Does Rent enter into the price of Commodities?
2. In what way does a Bill of Exchange differ from money?
3. In what way does an increase of money affect prices?
4. What are the advantages and disadvantages, with respect to the production and preservation of wealth, of the system which gives to the oldest son of a family the whole of its Landed Property?

DESCRIPTIVE GEOGRAPHY.

THREE HOURS ALLOWED.

The Candidate is only allowed to answer one half of the total number of questions in each Section.

Section I.

1. Name the county in which each of the following towns is situated:—Huddersfield, Axminster, Maidstone, Wells, Merthyr Tydvil, Grantham, Kidderminster, Stoke-upon-Trent, Wrexham, Lewes, Penzance, Aberystwith, Rochdale, Stockport, Paisley, Glasgow, Leith, Dundalk, Belfast, and Coleraine.
2. Enumerate the principal seaports that would be successively passed in making the circuit of the Mediterranean coasts, beginning at the Strait of Gibraltar. Mention the country to which each belongs.
3. Draw up a table of the political divisions of Italy, giving the capital, and the principal seaports, of each.
4. What is meant by the "overland" route to India? State the general course which a person going from England to India by this route would take, and name the places that constitute the chief stations on the journey.
4. Name, in geogaphical succession, the principal towns passed in ascending the stream of the Ganges, from the Bay of Bengal to the Himalaya mountains.
6. Draw up a list of the British Colonies and Dependencies in North America (exclusive of the West Indies), and give the principal towns of each.
7. Name eight among the largest cities of the United States, giving the position (whether on any river, or otherwise) of each, and the State in which it is situated.
8. From what countries does Britain derive her chief supply of the following articles:—Cotton, indigo, coffee, sugar, wool (sheeps'), tallow, and hides?
9. On what rivers are the following towns situated:—Turin, Prague, St. Petersburg, Stettin, Belgrade, Lucknow, Delhi, Cawnpore, Ava, Cincinnati, New Orleans, and Melbourne?
10. Where are the following seaports:—La Guayra, Callao, Kurrachee, Beyrout, Point de Galle, Akyab, Valparaiso, Charleston, Mobile, Quillimane, Bahia, D'Urban, Maulmein, and Tranquebar?
11. Name the colonial possessions and foreign dependencies of any one of the following States:—

(*a*) France.
(*b*) Holland.
(*c*) Denmark.

12. Draw a map to show the situation (with reference to adjacent geographical features) of any one of the following cities:—St. Petersburg, Vienna, Lisbon, or Constantinople.

Section II.

13. Draw a map of any one of the undermentioned countries,—marking on it the chief mountain-ranges, plains, and rivers, with the positions of the principal seaports:—

(*a*) France.
(*b*) Italy.
(*c*) China.

14. Draw a map of your own country, marking on it

the prominent features of surface, the river, and the sites of the principal towns.

15. Draw up a table of the political divisions of Europe, arranging the various countries under the head of empires, kingdoms, grand-duchies, &c., and naming the capital of each.

16. What territories are comprehended under the appellation of British India? Draw up, as well as you are able, a table of the different countries or provinces which it embraces, with the principal towns in each.

17. Enumerate the possessions of Britain upon the West Coast of Africa, to the northward of the equator, mentioning their characteristic articles of native produce, and the names of the chief seats of trade.

18. What constitute the principal commercial productions of the East Indian Archipelago, and between what nations is the traffic in them chiefly maintained.

19. In what parts of Great Britain and Ireland are the manufacture of textile fabrics (cotton, woollen, linen, and silk), and of hardware goods, chiefly carried on? (Specify the localities according to counties, and name the towns which are the more special seats of each manufacture.)

20. Draw up a table of the States and Territories that are comprised within the North American Union (United States), arranging them according to their position along the Atlantic coast—within the Valley of the Mississippi, or beyond the Rocky Mountains.

21. Enumerate, in the order of their respective settlement (according to priority of date), the Australian Colonies of Britain, with the chief towns of each.

22. Taking the total population of the globe at a thousand millions, of what amounts are respectively (in round numbers) the inhabitants of Europe, Asia, Africa, and America? In which of these divisions is the population, relatively to extent of surface, most dense?

23. Give a brief account of any one of the undermentioned British Dependencies, with reference to geographical position and features, commercial importance, and circumstances of acquirement by Britain:

(*a*) Gibraltar.
(*b*) Malta.
(*c*) Hong-Kong.

24. Indicate, by reference to modern localities to which their remains are proximate, the situation of the following cities of antiquity:—Nineveh, Babylon, Thebes, Memphis, Carthage, and Petra.

PHYSICAL GEOGRAPHY, INCLUDING GEOLOGY.

THREE HOURS ALLOWED.

Candidates are not to answer more than twelve questions in this paper.

Section I.

1. Give a brief account of the chief physical features of the county in which you live.

2. Name the chief headlands, inlets, and mouths of rivers, of one of the following coast-lines:—

(*a*) From the mouth of the Ouse to that of the Stour.
(*b*) From St. Bee's head to Hartland Point.
(*c*) From Malaga to Leghorn.

3. Describe the course of one of the following rivers from its source to its mouth, noticing the principal tributaries, the nature of the country drained by it, and any other particulars of importance:—

(*a*) The Trent. (*c*) The Po.
(*b*) The Ganges. (*d*) The Orinoco.

4. Write a short account of the Physical Geography of one of the following countries:—

(*a*) France.
(*b*) Spain.
(*c*) Egypt.
(*d*) New Zealand.

5. Under what heads may lakes be classified? Briefly describe any two of the following—(*a*) Lake Baikal; (*b*) the Dead Sea; (*c*) the Lake of Titicaca; (*d*) the Lake of Constance; (*e*) Windermere; (*f*) Loch Fyne.

6. Define a line of watershed. Describe as nearly as you can the line which separates the Eastern drainage of England from the Western.

Section II.

7. Describe the principal currents of one of the oceans. To what great causes are the ocean currents attributed.

8. What is an Isothermal line? What are the causes which prevent the Isothermal lines from coinciding with the parallels of latitude on the surface of the globe?

9. Give some account of the Monsoons. What appears to be the cause of them?

10. What is meant by a map of cotidal lines? To what use may such a map be applied?

11. Name the chief ranges of mountains and hills in Great Britain, and state the predominating geological character of each.

12. From what geological formations, and from what counties, do we obtain our chief supply of the following substances:—gypsum, tin, zinc, copper, common salt?

13. What is the probable origin of coal? What are the evidences of this origin? Name the chief varieties of coal. To what special uses is each variety applied?

14. Name, or exhibit in a map, the chief coal-fields of England and Wales, distinguishing those that are most important, and those which produce most iron. Which of the British Colonies produce coal?

15. Into what great geological regions may Scotland be divided? Can you connect this division with the different pursuits and characters of the inhabitants?

16. Give some account of the most remarkable extinct saurian animals, mentioning the formations in which their remains are found.

17. Explain the difference between valleys of elevation and valleys of denudation.

18. Describe, or show by a map, which are the great volcanic regions of the globe. What are the chief mineral products of volcanic districts?

19. Write an account of, or illustrate by a map, either (*a*) the distribution of the most valuable domesticated animals, (*b*) that of the most important kinds of grain, or (*c*) that of the most useful fruits.

20. Give a short description of the varieties of the human race and of their geographical distribution.

ENGLISH HISTORY.

THREE HOURS ALLOWED.

You are to answer the whole, or as many as you can, of the eight following questions.

1. Whom did Edward the Confessor succeed on the throne of England? Who were the claimants to the throne after the death of Edward the Confessor? How, when, and where did each of those claimants die?

2. Give a short account of Wat Tyler's insurrection.

3. Write down the names of our principal Statesmen, and Military and Naval Commanders during the reign of Queen Elizabeth.

4. Mention the names of the Sovereigns of the House of Stuart who have reigned in England; and give, as nearly as you can, the dates when the reign of each commenced, and when it ended.

5. When was the Bill of Rights passed? What does it enact about Standing Armies?

6. Mention the names of the most eminent English writers who flourished during the reign of Queen Anne.

7. What Countries and places, beyond the British Islands, were parts of the Dominions of George the Third, at the time of his Accession?

8. In what reign, and against what enemy was each of the following battles fought?

Agincourt,	Crecy,	La Hogue,
Bannockburn,	Dettingen,	Plassy,
Blenheim,	Flodden,	Quebec,
Bovines,	Fontenoy,	Wandewash.

You are to answer any four, or as nearly four as you can, of the following eight questions.

You are to select those which you think yourself best able to answer fully.

No marks will be obtained by answering more than four.

1. State and explain the chief Articles of the Treaty of Utrecht; and give a brief account of the English Ministers by whom it was concluded.

2. State and explain the chief provisions of the Act of Settlement; and give a brief account of the origin and functions of the Privy Council.

3. What is meant by a Writ of Habeas Corpus? Cite the words of the Great Charter which affirm the principle on which it is founded. How was its operation secured and extended by the Habeas Corpus Act, in the reign of Charles II.? Cite instances of the suspension by Parliament of the Habeas Corpus Act.

4. Describe the origin and growth of our Hereditary Peerage, comparing it with the Noblesse of France; and give a brief account of the attempt made in the reign of George I. to limit the Royal Prerogative of creating Peers.

5. Quote the words of the Great Charter which affirm the principle of Trial by Jury. In what respect did the functions of the ancient Juries differ from those of modern Juries? Give a brief account of the arguments and judgment in Bushel's case, in the reign of Charles II., as to the legality of fining Jurymen for a perverse verdict.

6. What are the chief distinctions between a Parliamentary Impeachment and a Bill of Attainder? Give a brief account of the proceedings against Lord Strafford, Sir John Fenwick, Lord Somers, and Lord Oxford.

7. Trace in the Great Charter of John, and in the Statute of Edward I., entitled "Confirmatio Cartarum," the early indications of the principle that Taxation without Parliamentary consent is illegal. Show how this principle was affirmed and extended by the Petition of Right. Show how the mode in which the Appropriation Acts have been passed since 1688 has increased the control of the House of Commons over the executive power.

8. What were the conflicting claims of the American Colonists, and of the Crown, which led to the American War? State the general distinctions between the Constitutional rights of British subjects, who form a Colony in a Country previously uninhabited by a civilised race, and the rights of those who settle in a Dependency which the Crown has acquired by conquest or cession from other Powers.

(To be continued.)

UNIVERSAL CURRENCY.

A plan for a universal currency has been published in a pamphlet, by Mr. T. A. Tefft, who is at present in this country, prosecuting inquiries as State Commissioner of Industrial Art Education for Rhode Island, United States. Mr. Tefft's plan is to bring the French, the American, and our own currency into accord with each other, and this he considers, for all practical purposes, solves the question of a universal currency. In his pamphlet he addresses himself to the answering the following questions:—

"What unit is best suited to an universal currency?

"What shall be the coins above, and the divisions below, the unit?

"What shall be the standard weight and fineness?"

He says:—"In seeking for a unit as a basis of this general system, it is important to select one that already exists in a large and increasing currency, if such an one can be found to answer the purposes best, and render the recoinage necessary on about the same conditions in each of the three countries. It is also desirable to select a medium unit between the extremes which exist, if this is practicable.

"The unit of the dollar will be found to answer those conditions.

"It already exists in a coinage of five hundred millions, is of ancient origin, is best known in the different quarters of the globe, has its counterpart in the Italian and Spanish currencies, and it is the intermediate unit between the franc and the pound.

"I propose, then, the dollar as the universal unit.

"Its value to be exactly the same as five francs of the French, or four shillings of the English currency, under the new system. This unit of the currency, the dollar, to exist only in the gold coin; no silver coinage allowed in pieces larger than fifty cents, or half-a-dollar.

"The pieces of coinage to be—

In Gold......	1	dollar, or the unit.	
	$2\frac{1}{2}$	dollars.	
	5	,,	the present sovereign.
	10	,,	the new sovereign, the Napoleon or eagle.
In Silver ...	50	cents.	
	25	,,	the English shilling.
	(20	,,	the franc, for France only.)
	10	,,	
	5	,,	
In Copper...	2	,,	the English penny.
	1	cent,	the French sou.
	$\frac{1}{2}$	,,	or 5 mils.
	($\frac{1}{4}$	,,	or $2\frac{1}{2}$,, for England.)
	($\frac{1}{5}$	,,	or 2 ,, for France.)

"For the standard in weight, I propose the French coinage—the only coinage based on a decimal weight, with a very slight change—in order to have the dollar, 1·6 grammes, a simple quantity, instead of the present fractional weight of five francs in gold, 1·6129; and the weight of the dollar in silver, 22·5 instead of 25 grammes, the present weight of five francs. Then the ratio between the two metals would be 14·0625. This would scarcely disturb the gold standard in France and England, and merely raise the value of silver in France to its corresponding value to gold in England and America.

"All gold and silver coinage to be nine-tenths fine.

"The copper coin—the coin of greatest token value—to be of the same mixture as now used in France, viz., 95 copper, 4 tin, 1 zinc, and the same weight.

"This mixed copper coin would then have, for the same value, only about half the weight of the copper coin now used in England and America.

"The national pieces of gold coin, the Napoleon, the sovereign, and the eagle, should each be 10 dollars, the largest piece of coinage. This would simply require the name sovereign to be applied to double its present value, and the application of the name Napoleon to 50 instead of 20 francs, as at present, the application of these names being purely conventional. These pieces should have the national arms, in place of the numerical value, stamped upon all the other coins, opposite the medallion side, thus giving to the largest pieces of coinage the greatest nationality, and occasion for the highest artistic treatment.

"In silver, the English shilling would be 25 cents, and the florin would be 50 cents, the largest silver piece in the new currency. In France, the five-franc and two-franc pieces would be dispensed with, and the half-dollar employed in their stead. The franc would be retained, from its long-established name and associations, as 20 cents, instead of dividing the half-dollar into quarters, as in England and America.

"In copper coin, the two-cent piece, the same as the ten-centime piece now used in France, would be the penny in England; and the cent, or centime, as it would be called in France, would be equal to five centimes of the present French money, or nearly the halfpenny in England. The half-cent would represent the farthing, and the quarter-cent, or $2\frac{1}{2}$ mil-piece, would be required to make the exact change for sixpence and threepence of the present English money; while the one-fifth cent, or 2 mils, would be precisely the same as the present centime in France.

"In this re-stamping of money, the French coins now issued should be regarded as the models of taste and excellence.

"Under this plan, then, the proposed coinage would have in each country the same unit, the same weight, the same fineness, and the same decimal divisions, thus: 10 mils = 1 cent, 100 cents = 1 dollar; 10 dollars being 1 sovereign, Napoleon, or eagle.

"In this manner, the national types of coins, the shilling and the franc, which usually take a strong hold on the people, and the names partaking of individuality and pride, the Napoleon, the Sovereign, and the Eagle, would be retained; and it is fair to suppose, that the intermediate and the ancient unit of the dollar would be recognised as more convenient than the unit of any other currency.

"In the following tables may be seen the present currencies of France, England, and America, with their fineness and weights, and the proposed universal currency. Also, a comparison between the standard weights of the principal coins, as they now are, and as proposed in the universal currency.

PRESENT CURRENCY.

FRANCE.

The unit, 1 franc (100 centimes).

	Coins.	Weight in Grammes.		Troy Grains
Gold, $\frac{9}{10}$ fine.	5 francs	1·6129		24·8914
	10 ,,	3·2258		
	20 ,,	6·4516		
Silver, $\frac{9}{10}$ fine.	5 ,,	25		385·85
	2 ,,	10	$2\frac{1}{2}$ francs...	192·925
	1 ,,	5		
	50 centimes	2·5		
	20 ,,	1		
Copper, 95; Tin 4; Zinc 1	10 ,,	10		
	5 ,,	5		77·17
	2 ,,	2		
	1 ,,	1		

GREAT BRITAIN.

	Coins.		Troy Grains.
Gold, $\frac{11}{12}$ fine.	10 shillings		61·637
	20 ,,	sovereign...	123·274
	40 ,,	double sovereign	246·548
	100 ,,	five pounds	616·372
Silver, $\frac{37}{40}$ fine.	5 ,,	crown	436·364
	$2\frac{1}{2}$,,	half-crown	218·182
	2 ,,	florin...	174·545
	1 shilling		87·273
	6 pence...		43·636
	1 penny		7·273
Copper.	1 ,,		291·667
	$\frac{1}{2}$,,		145·833
	$\frac{1}{4}$,,		72·917

UNITED STATES.

	Coins.	Troy Grains.
Gold, $\frac{9}{10}$ fine.	1 dollar, the unit (100 cents)	25·8
	$2\frac{1}{2}$ dollars	64·5
	3 ,,	77·4
	5 ,,	129·
	10 ,, the eagle...	258·
Silver, $\frac{9}{10}$ fine.	1 dollar...	384·
	50 cents...	192·
	25 ,,	96·
	10 ,,	38·4
	5 ,,	19·2
Mixed	3 ,,	
Copper.	1 cent	168·
	$\frac{1}{2}$,, or 5 mils	84·

PROPOSED UNIVERSAL CURRENCY.

The unit, 1 dollar (100 cents).

	Coins.	Weight in Grammes.	Troy Grains.
Gold, $\frac{9}{10}$ fine.	1 dollar	1·6	24·6944
	$2\frac{1}{2}$ dollars	4·	...
	5 ,,	8·	...
	10 ,, sov., Nap., or eagle	16·	...
Silver. $\frac{9}{10}$ fine.	50 cents, half dollar...	11·25	173·6325
	25 ,, $\frac{1}{4}$ dol., shilling...	5·625	...
	(20 ,, franc, for France	4·5)	...
	10 ,,	2·25	...
	5 ,,	1·125	...
Copper, 95; Tin 5; Zinc 1	2 ,, (penny)	10·	...
	1 cent (sou)	5·	77·17
	$\frac{1}{2}$,, 5 mils	2·5	...
	,, ($2\frac{1}{2}$,, for England	1·25)	...
	,, (2 ,, for France	1·)	...

Comparison between the Standard Weight of Coins as they now are, and the Proposed Universal Currency.

	Present Weight in Troy Grains.		Proposed Weight in Troy Grains.	Proposed Weight in Grammes.
GOLD.				
5 francs ($\frac{9}{10}$)	24·8914 *	1 dollar =	24·6944	1·6
4 shillings ($\frac{11}{12}$), $\frac{1}{54}$ added for diff. in fineness	25.1114			
1 dollar ($\frac{9}{10}$)	25·8			
SILVER.				
$2\frac{1}{2}$ francs ($\frac{9}{10}$)	192·929	$\frac{1}{2}$ dollar =	173·6325	11·25
2 shillings ($\frac{37}{40}$), $\frac{1}{36}$ added for diff. in fineness	179·393			
$\frac{1}{2}$ dollar ($\frac{9}{10}$)	192·			
COPPER.				
1 sou, or 5 centimes	77·17	1 cent =	77·17	5·0
$\frac{1}{2}$ penny	144·833			
1 cent	168·			

* The new five-dollar piece ... ... 123·472 grains troy.
Present sovereign ... ... 123·274 ,,

"I am perfectly aware that the plan I have here proposed for attaining an universal currency is novel and bold; but I feel quite confident that some plan like this must be employed to accomplish this much desired result.

"Here are three great countries, with their established currencies interwoven with all their pleasure and business habits; each country has its prestige and its pride; and, notwithstanding the advantages to be derived from a common currency may be well understood and acknowledged, yet, it is not at all probable that any two of these countries would adopt the entire system of the third. The French are satisfied with their system; the Americans with theirs; and the English, unless some arrangement like the above succeeds, are likely to have a third decimal system, with the pound sterling for the unit. This has been recommended by the last parliamentary committee appointed to report on the subject; and any one at all familiar with the English character would expect no other result. In no nation of the world is there more reason for pride and love of country than in Great Britain. To entirely change the currency in such a country would be impossible. The most that could be expected, would be the adoption of a more convenient unit, with decimal divisions and decimal weight, employing at the same time its most familiar type of coin," the shilling.

The silver coinage would have to be adjusted for the change of standard fineness. A gold standard is to be adjusted by the three nations, and silver is to be "no longer a legal tender for more than ten dollars in amount." To carry out the system Mr. Tefft says:—

"Let a commission be appointed by the British Parliament, one by the French Emperor, and one by the American Congress, to meet in convention at Brussels, during the coming year, in order to determine upon some plan like the above; and the first practical step will have been taken. Such a convention, if composed of judicious men, would undoubtedly determine upon a mode of introducing the universal currency, that would meet with general approval, and, by means of international treaty, be adopted by the different governments."

RAILWAY ACCIDENTS IN FRANCE AND ENGLAND.

The following has been received from the editor of the *Mechanics' Magazine*:—

"From an interesting article which recently appeared in the Paris *La Patrie*, setting forth many important facts respecting accidents on the French railways,—which are, of course, more immediately under the control of the State than the English,—we learn that a commission has presented to the Emperor a volume entitled 'Enquête sur les moyens d'assurer la régularité et la sûreté de l'exploitation sur les chemins de fer,' containing the results of examinations of officials from the railways du Nord, de l'Est, de Paris à Lyon, de Saint Germain, de Paris à Rouen, au Havre et à Dieppe, de l'Ouest, du Grand Central, and de Sceaux et Orleans. The volume is but preliminary, and is to be followed by others giving still more extensive results. The following facts are derived from it:

"Between the 7th September, 1835, and the 31st December, 1856, the number of railway passengers in France was 224,345,769. Of this number 1,979 were injured, and 999 killed—in all, 2,978. It is worthy of remark that of these accidents 1,134 only—334 killed and 800 wounded—arose from defects in the working of the railways; while 1,844—665 killed, and 1,179 wounded—resulted from individual imprudences which were not attributable in any degree to the railway companies. Taking away the agents and servants of the companies, the number of passengers killed by the working of the trains is but 111, that is 1 in 2,021,133; and of passengers wounded, 402—1 in 558,074.

"These facts speak much in favour of the working of railways in France, and present new inducements for us in this country to give the railway system at home more serious attention than has yet been bestowed upon it. We mention this, because it is becoming more and more apparent to us that the mitigation and prevention of accidents upon railways are left too exclusively in the hands of railway companies, and require a new form of public opinion to be brought to bear upon them. It is true that this subject is frequently brought before our professional institutions, such as the Institution of Civil Engineers, the Institution of Mechanical Engineers, &c.; but many of the members of these institutions have so direct an interest in the preservation of the existing railway systems, or in the furtherance of special schemes of improvement, that the matter does not, we think, there meet with the full and unprejudiced discussion which it deserves. For this reason we think it desirable that some more independent society, such as the Society of Arts, for example, should give its attention to it; and, although it might fail to deal fully with all the technical points of difference which might arise, it could certainly collect such facts and opinions as would speedily bear fruit in increased safety of railway transit."

SOUTH KENSINGTON MUSEUM.

During the week ending 17th July, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,201; on Monday and Tuesday (free evenings), 4,895. On the three Students' days (admission to the public 6d.), 702; one Students' evening, Wednesday, 157. Total, 9,955.

Home Correspondence.

LONDON MECHANICS' INSTITUTION.

Sir,—The Committee of the London Mechanics' Institution have published a communication which goes upon the assumption that they are subjected to a very unfair competition with regard to other Institutions.

The high class and cheap instruction of Government Institutions, and the necessity for well-paid professors to make the instruction in Mechanics' Institutions efficient, is quite a delusion. The only Government Institutions to which these remarks can possibly apply, are the South Kensington Museum and the School of Mines. At South Kensington a man may possibly learn much more with his eyes than he could with his ears at Southampton-buildings, but the teaching of a well-arranged museum is not what is generally understood by the class instruction of a Mechanics' Institution, nor is there any fair comparison when one is shown against the other. The teaching by objects in a museum is a mere expansion of a Pestalozzian lesson; it is a kind of teaching best adapted to the educational condition of the people. The masses have not yet risen above material forms, and if you interest them at all, it is by things, and not words.

But look at the cheap lectures at South Kensington and Jermyn-street by well-paid professors; how is the London Mechanics' Institution to compete against these? Crosby Hall, the Working Man's College, the Evening Classes at the Polytechnic, the Mechanics' Institutions of Huddersfield and Leeds, have competed successfully against Government Institutions. The results of the last examination will show what Mechanics' Institutions can do, if they have only the spirit and will to do it.

I cannot speak positively on this subject, but I should think the evening lectures at Kensington and Jermyn-street were never intended to supply the regular systematic teaching of a well-arranged class. Who ever heard of a man becoming a physicist by attending six lectures at Jermyn-street, or a comparative anatomist by attending one lecture of Professor Owen's at South Kensington. It is scarcely fair to draw any comparison between the advantages which the graduates of the London University, or the matriculated students of Jermyn-street, enjoy over those who usually attend the classes of a Mechanics' Institution. The students in the one case are studying for a distinct and specific object; in the other it is to improve and remedy in some degree the defects of a neglected education. The subjects usually taught in a Mechanics' Institution are elementary; the subjects taught at Jermyn-street are technical. Too much stress is laid upon lectures. A man may attend lectures till he grows deaf and stupid. Lectures and examinations are but the instruments of education. The work, if it is to be done, must be done by the unwearied diligence and determined spirit of the student. Lectures are a valuable means of education; they indicate the road that has to be travelled, soften difficulties, and prevent useless and desultory reading. But to suppose well-paid professors are best suited for this work is against all my experience. Oxford and Cambridge men rarely succeed as good teachers of the working classes. Depend upon it the best educators are the best men taken from the class they have to educate. A good elementary schoolmaster, who understands his subject, is the best man for Mechanics' Institutions. If committees fall into the notion that well-paid professors are necessary for these classes, then there is an end to all class teaching in Mechanics' Institutions. My experience is rather against the opinion that these classes can be made self-supporting. A low fee for attendance, the expense of apparatus and rent, would leave but a small sum for the teacher. Some pecuniary aid on tested results would, perhaps, be the easiest and best method of assistance.

I should regret the failure of an Institution which has done much good. For years this Institution did its work well; and I have found in almost every part of the country men who have attributed their success in life to the lectures and class instruction of the London Mechanics' Institution. I am, &c., C. B.

Proceedings of Institutions.

Kingston.—The last report of the Mechanics' Institute states that its success has much exceeded that of any former year, and has far surpassed the expectations of its most sanguine supporters and friends. The Institute was established in October, 1852, its design being the rational entertainment of the members and the more general diffusion of useful knowledge by means of lectures and discussions on subjects of general interest; the establishment of a library and reading room and classes for mutual instruction amongst the members. Since the first formation of the Institute, a library of one thousand volumes has been collected. During the past year upwards of six hundred volumes have been added, an entire re-arrangement has been made, and a catalogue printed. At a Special General Meeting of the members, held on 30th December last, it was resolved, "That a donation of five pounds should entitle the donor to a life membership of the Institute."—The balance sheet shows that during the past year the donations of life members have added fifty pounds to the income. The county magistrates have kindly granted the grand jury room to be used by the members of the Institute, as a reading room, from 6 till 10 o'clock in the evening, daily (Sundays excepted). A drawing class has been conducted by three members of the committee, which, with the other classes for instruction, will be again opened during the ensuing session. The committee thank Messrs. Hayes, Reah, and Scrimgeour, for their exertions and attention to the drawing class. The president and Dr. Ellis, (a vice-president), kindly consented to represent the Institute at a local board of examiners formed by representatives from the Kingston, Richmond, and Brentford Institutes, for the purpose of examining candidates for the prizes and certificates offered by the Society of Arts. During the past session the following lectures have been delivered:—J. M. Clabon, Esq., "More Worlds than One," (two lectures); Ditto, "An Evening with the English Poets;" Professor Griffiths, "Experimental Chemistry;" A. J. Johnston, Esq., "Self-Educated Men;" W. Duncan, Esq., "Rambles on the Rhine;" Colman Burroughs, Esq., "English Journals and Journalism;" Mr. John Collings, "India" (three lectures); Mr. Hogg, "British Workman;" Mr. Strachan, "Artificial Light;" Mr. Fairbairn, "A night wi' Burns." There have also been soirées, comprising musical entertainments by the members, and a concert. The lectures (with one exception) were delivered gratuitously, and the attendance of members and friends was uniformly large. The committee gave free admission to a large number of working men who were not members of the Institute, which act of liberality has been much appreciated. The present state of the funds is very encouraging. The receipts by subscriptions and donations, and for admission to lectures, for the year ending the 24th June, 1858, amount to £163 17s. 11d.; the expenditure for the same time being only £82 14s. 1d., leaving a balance of £81 3s. 10d. in favour of the operations of the Institute for the past year. This balance has been applied towards the liquidation of a debt of £135 11s. 9d., due by the Institute, which had accrued from time to time during the period from 1852 to 1857. The committee take great encouragement from the much improved state of the library, and steady increase of the funds, arising from the yearly subscriptions of the members themselves. They rejoice to find that the number of 115 members at the commencement of the year, has been increased to 272. The committee desire to tender, in the name of the members, their warmest thanks to J. M. Clabon, Esq., the president, for his continued and unwearying interest in the prosperity of the Institute; to His Royal Highness the Duke of Cambridge, and the noblemen and gentlemen who have become patrons and vice-presidents; to the friends who have delivered lectures, and to those who have kindly contributed to increase the library by their gifts of many valuable books, and to all the elected officers for the efficient discharge of their honorary duties, during the season now closed.

Lockwood.—Through the kind permission of J. W. Crosland, Esq., the members and friends of the Mechanics' Institution held a *gala* in the park of Thornton Lodge on Saturday, the 10th inst. There were about 1,000 persons present. Among others were J. W. Crosland, Esq., and Mrs. J. W. Crosland, T. P. Crosland, Esq., J.P., Rev. T. B. Benster, M.A., Bentley Shaw, Esq., J.P., President of the Institution, and Mrs. Bentley Shaw. All present seemed to enjoy themselves, and it is satisfactory to be able to report that so much pleasure was not unattended with some degree of pecuniary profit to the Institution.

Nailsworth.—The Members of the Literary and Mechanics' Institute made an excursion to Tortworth Court, the seat of Earl Ducie, on Tuesday, the 13th instant. The number present amounted to upwards of 170. Several spring waggons were lent for the occasion by Mr. W. Holmes, and they were horsed by Mr. Brooks and Mr. Clissold. Lord Ducie having kindly granted the use of his park, the party, after dining under the trees, amused themselves by visiting various parts of the grounds, rowing on the lake, playing quoits, cricket, &c.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 14th July, 1858.

412. Destitution (Gweedore and Cloughnaheely)—Report from Committee.
343. Oxford University—Report of the Commissioners.
403. Metropolis Drainage—Return.
185. Bills—Leasing Powers (Ireland).
194. ——— Law of False Pretences Amendment.
195. ——— County Court Districts.
196. ——— Church Rates Commutation.
197. ——— Sheep, &c., Contagious Diseases Prevention.
198. ——— Ecclesiastical Jurisdiction Continuance.
199. ——— Charitable Trusts Acts Continuance.
200. ——— Turnpike Trusts Arrangements.
201. ——— Copyhold and Inclosure Commissions, &c.
202. ——— Indemnity.
203. ——— Sale of Poisons, &c.
204. ——— Cornwall Submarine Mines.
205. ——— Ecclesiastical Commission.
206. ——— Army Service.
207. ——— Inclosure of Lands.
208. ——— Markets and Fairs (Ireland) (as amended by the Select Committee).

Poor Law Board—10th Annual Report.

Delivered on 15th July, 1858.

162. Estimates for Civil Services—General Abstract.
162 (7) (1). General Board of Health—Estimate.
411. Railway and Canal Legislation—Report from Committee.
426. Army (Barracks)—Supplementary Estimate.
427. Army (Survey of the United Kingdom, &c.)—Supplementary Estimate.
428. Militia Estimates—Report.
379. British Museum—Return.
209. Bills—County, &c., Property Conveyance (amended).
210. ——— Jews.
211. ——— Oaths—Lords' Reasons for insisting on their Amendments.
212. ——— Returns to Secretary of State.
218. ——— Turnpike Acts Continuance.

Delivered on 16th July, 1858.

369. War Department—Copies of Correspondence (a corrected Copy).
390. British Museum—Returns.
410. Slave Trade (Cuba)—Return.
422. Militia (Volunteers)—Return.

Fisheries (Ireland)—Report of the Commissioners.

Delivered on 17th and 19th July, 1858.

391. East India (Sunday Trains)—Copy of Correspondence.
395. Poor Law (District Schools)—Return.
396. Poor Relief (Wick)—Return.
405. Chamber of London—Annual Accounts.
408. East India (Alumbagh)—Return.
409. Constabulary and Revenue Police (Ireland)—Return.
417. Foreign Office Re-construction—Report.
418. Contracts (Public Departments)—4th Report.
421. Friendly Societies (Scotland)—Report by the Registrar.
423. Iron Ordnance Factory (Woolwich)—Returns.

432. Stevens' Regulating Air Doors—Copy of Report.
351. Finance Accounts—Classes 1 to 8.
215. Bills—Wine, &c.—Ireland.
216. ——— Metropolis Local Management Act Amendment.
218. ——— New Writs (amended).
217. ——— Evidence on Oath (Private Bill Committees).
219. ——— Corrupt Practices Prevention Act Continuance (amended).
220. ——— Universities and College Estates (Lords Amendments).
221. ——— Incumbered Estates (West India) Act Amendment.
222. ——— Marriages (Moscow, Tahiti, and Ningpo).

Delivered on 20th July, 1858.

381. Bank Acts—Report from Committee.
425. Army in the East—Dr. Mapleton's Report.
439. Appropriation Bill—Copy of Correspondence.
440. Carlisle Diocese—Returns.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July* 16, 1858.]

Dated 29th May, 1858.

1218. J. Schloss, 75, Cannon-street West, City—A so-called book clasp, or improved fastening of books, being also applicable to pocket-books, ledgers, blotting cases, and similar articles where locks, bolts, or clasps are employed.

Dated 8th June, 1858.

1290. W. Clark, 53, Chancery lane—The manufacture or preparation of extract of Peruvian guano. (A com.)

Dated 10th June, 1858.

1320. W. Davis, Loveday-street, Birmingham—Certain imp. in the tangs of awls, also in the mode of manufacturing awl-blades, or similar articles, and likewise in the stocks or pads for holding the same.

Dated 12th June, 1858.

1338. W. Clark, 53, Chancery-lane—A new treatment or preparation of a vegetable product, and its application as a fibrous or textile material. (A com.)

Dated 18th June, 1858.

1377. W. Blizzard, 14, Victoria-terrace, Ladbroke-road, Notting-hill—Imp. in india-rubber, gutta percha, and drying and other oils.

Dated 24th June, 1858.

1425. P. Griffiths, Manchester-road, Burnley, Lancashire—Imp. in the manufacture of shaft couplings.
1427. J. Robinson, East India-road—Imp. in applying and adapting water-closets to ships, so as to ensure the safety and more perfect ventilation of the same.
1429. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for making bolts and rivets. (A com.)
1430. B. Pickering, Lockerbie, Dumfries, N.B.—Imp. in apparatus for communicating signals from one part of a railway train to another.

Dated 25th June, 1858.

1433. C. Nightingale, Wardour-street, Soho—Imp. in apparatus applicable to curling and spinning machines for horse-hair and other materials.
1435. R. Smith, 45, Essex-street, Strand—Imp. in fire-arms and ordnance, and in the projectile to be used therewith.
1437. J. Westwood, London-yard, Isle of Dogs, Poplar—Imp. in the plating of ships and floating and other batteries, to render the same shotproof.

Dated 26th June, 1858.

1439. P. M. Crane, Irish Peat Company's Works, Athy, Ireland—Imp. in the manufacture of fuel from peat.
1441. W. L. Tizard, Mark-lane—An improved method of treating brewers' and distillers' malt or grist.
1443. W. Woofe, Gloucester—Imp. in implements for paring, hoeing out, and clearing land, and for depositing seed.
1445. T. V. Flinn, Edward's-place, Deynesford-road, Camberwell-green—Imp. in sash-bars, for the purpose of drainage.
1447. E. Pinchon and W. R. Harris, Elbeuf, France—Imp. in machinery for manufacturing healds or harness used in looms for weaving.
1449. W. H. Preece, 7, Bernard-street, Primrose-hill, and J. L. Clark, Adelaide-road, Haverstock-hill—Imp. in electric telegraphs.

Dated 28th June, 1858.

1451. I. Hammond, Winchester—Drawing the cartridge case from the barrel of a breech-loading gun.
1453. J. Lui, 13, Welbeck street, Cavendish-square—An improved machine for reaping corn. (A com.)
1455. G. Morris, Regent-street—An imp. in shirt and other collars.
1457. C. W. Siemens, John-street, Adelphi—Imp. in cleansing tidal rivers.
1459. W. E. Newton, 66, Chancery-lane—A new mode of applying engraved plates, or electrotype or other substitutes for such plates, to the cylinders of printing presses, and of applying other parts of such presses in combination with the cylinders to enable perfect impressions to be taken from the cylindrical surfaces of the plates. (A com.)

Dated 29th June, 1858.

1461. F. A. Calvert, Manchester—Imp. in machinery for cleaning and preparing cotton, wool, and other fibrous materials.
1463. J. Shaw, Manchester—A machine to manufacture square paper and other bags.
1465. J. Harcourt, Broad-street, Birmingham—An improved adjustible spindle for locks and latches.
1467. W. Baker, 8, Albert-villas, Seven Sisters-road, Holloway—Imp. in constructing covered ways for the passage of sewage on the banks of rivers.

Dated 30th June, 1858.

1469. P. P. C. Barrat and J. B. Barrat, 33, Boulevard St. Martin, Paris—Imp. in machinery for digging, reaping, mowing, and performing certain agricultural operations, and for cutting drains and excavating, partly applicable to arrangements for communicating motion for other purposes.
1471. S. Fattorini, Milan (Italia)—An universal meridian, applicable to mathematical, geometrical, and precise instruments.
1473. W. Capstick, Liverpool—Imp. in wheels for carts or vehicles to run on common roads.

Dated 1st July, 1858.

1475. H. G. Pearce, Liverpool—Imp. in reefing the sails of navigable vessels.
1477. W. Clark, 53, Chancery-lane—Imp. in gridirons. (A com.)
1479. T. Blinkhorn, Spalding, Lincolnshire—Imp. in the construction of steam boilers and engines.
1481. H. W. Wimshurst, 7, Wilmot-road, Dalston—Imp. in manufacturing sheet metal.

Dated 2nd July, 1858.

1483. C. F. Vasserot, 43, Essex-street, Strand—An improved wire-conductor for electro-magnetic machines. (A com.)
1485. F. Richmond and H. Chandler, Salford—Imp. in machines for cutting hay, straw, and other vegetable substances.
1487. P. R. Hodge, 16, Chalcot-crescent, Regent's park, and G. Spencer, 6, Cannon-street West—Imp. in the means of preventing or regulating the recoil of springs used in railway engines, carriages, and station buffers.
1489. W. Sellers, Philadelphia—Imp. in machinery for turning metal shafting or bars and cylindrical rings and cutting screws.
1491. J. L. Clark, Adelaide-road, Haverstock-hill—An imp. in electric telegraph cables or ropes.

Dated 3rd July, 1858.

1493. T. Scott, Drummond-street, Euston-square—Imp. in dressing, separating, and cleaning seeds, and in apparatus for these purposes.
1495. S. Lees, Bury, and J. Jaques, Preston—Imp. in the means for generating steam and economising fuel.
1497. T. Restell, New Kent-road—Imp. in breech-loading fire-arms and ordnance, and in ammunition to be used in breech-loading arms.
1499. J. Chisholm, Bermondsey—A method of disinfecting and deodorizing or treating sewage and other matters and structures and places.
1501. O. Sarony, Scarborough—Imp. in treating and colouring photographic pictures.
1503. A. V. Newton, 66, Chancery-lane—Imp. in soldering irons. (A com.)
1505. E. Haeffely, Kearsley, Lancashire—Imp. in recovering oxides of manganese from products arising out of the manufacture of chlorine, and in raising commercial manganese to higher oxides.

Dated 5th July, 1858.

1507. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of cast steel. (A com.)
1509. J. Hodgkinson, Atherton—Certain improved machinery or apparatus for kneading dough in the manufacture of bread.
1511. M. Nelson, New York, U.S.—Imp. in propellers for vessels.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1558. W. Northen, 14, Vauxhall-walk, Lambeth—The application of stoneware or earthenware, coloured or plain, to improved and original designs.—12th July, 1858.

WEEKLY LIST OF PATENTS SEALED.

July 16th.

2798. W. F. Batho and E. M. Bauer.
88. G. A. Tremeschini.
89. B. B. Wells.
93. O. von Corvin.
95. R. Martin.
96. T. Heppleston.
101. R. A. Brooman.
190. J. Sholl.
885. G. Smith.
1017. W. Wallis, W. Langford, and J. Slack.
1110. G. M. Casentini.

July 20th.

100. C. Rishworth.
107. T. Ivory.
120. W. Basford.
128. J. Johnston.
154. W. Spence.
674. T. Steven, T. Reid, and T. Frew.
694. A. P. Dadley & N. Brough.
1148. A. P. Price.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

July 12th.

1577. R. Yeates.
1586. T. Sadleir.
1608. W. C. Thurgar.

July 13th.

1566. J. H. Tuck.
1587. F. Burke.
1627. J. G. Lawrie.

July 15th.

1593. J. B. Pascal.
1633. J. H. Johnson.
1634. J. H. Johnson.
1642. J. H. Johnson.

July 16th.

1599. W. Pidding.
1620. A. E. L. Bellford.
1629. D. Fisken and T. R. H. Fisken.
1684. B. Bailey.

July 17th.

1614. W. Smith.
1622. V. Scully and B. J. Heywood.
1624. R. Martin and J. C. Martin.
1628. P. Bertinetti.
1668. A. Achard.

Journal of the Society of Arts.

FRIDAY, JULY 30, 1858.

NOTICE TO INSTITUTIONS.

In accordance with the resolution passed at the last Annual General Meeting of the Society, the Council will present to each Institution in Union a quarto copy of the Speeches and Addresses of H.R.H. the Prince Consort.

The Department of Science and Art have placed in the hands of the Council a number of copies of the "Introductory Addresses on the Science and Art Department and the South Kensington Museum," delivered there during the last session, and a copy of this work will also be presented to every Institution in Union.

In addition to the above, the Council have decided to present to each Institution copies of twenty-two lectures delivered before the Society of Arts, on the results of the Great Exhibition of 1851.

Institutions desiring copies of these works are requested either to apply for them at the Society's House, or to communicate to the Secretary of the Society of Arts the address of an agent in London to whom they may be sent.

SPECIAL PRIZE.

The Prize of Twenty Pounds (placed at the disposal of the Council of the Society of Arts for this purpose, by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., will be awarded according to the following conditions :—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breadth must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*—It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

Competitors are desired to take notice that the Council reserve to themselves the right of withholding the prize should there be no article of sufficient merit brought under their notice.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 1st of January, 1859.

FINANCIAL PRIZE ESSAY.

Mr. J. T. Danson, Fellow of the Statistical Society; Mr. Charles Neate, Professor of Political Economy in the University of Oxford; and Mr. Jacob Waley, Professor of Political Economy in University College, London, the adjudicators appointed by the Council of the Society of Arts, have reported that they have unanimously selected the Essay marked E. C. S., as deserving the award of the Prize of Two Hundred Guineas, placed in the hands of Council by Mr. Henry Johnson.

As the Council are not meeting at this season of the year, the Chairman, in the presence of the Secretary, has opened the envelope bearing the above motto, and declares that the successful author of the Essay is Mr. Edward Capps, 7, Cheshunt-terrace, Grange-road, Bermondsey.

ARTISTIC COPYRIGHT.

The petition from the Society of Arts, as well as one signed by Members of the Artistic Copyright Committee and others interested in the production of works of Fine Art, were presented to the House of Lords, on Monday last, by Lord Lyndhurst. The petitions were ordered to be referred to a Select Committee, the members of which were at once appointed.

EXAMINATIONS.

The following is a list of the members of the Sussex Local Board of Examiners, as now finally constituted, for the purpose of carrying into effect in Sussex the Examinations of the Society of Arts and the "Middle-Class Examinations" established by the Universities of Oxford and Cambridge :—

Airey, George, Steyning.
Allen, Rev. John, Brighton.
Andrews, John, Brighton.
Attree, W. W., Recorder of Hastings.
Banks, John, jun., Hastings.
Beard, Dr. C. J., Brighton.
Bessant, R. B., Brighton.
Bigge, A., Stipendiary Magistrate, Brighton.
Blencowe, R. W., the Hooke, Lewes.
Brigden, John, Brighton.
Burrows, J. C., Mayor of Brighton.
Carey, Rev. Dr., Brighton.
Carpenter, Charles, Brunswick-square, Brighton.
Cobb, George, Brighton.
Cole, J. H., Hastings.
Cox, A., Clarence-square, Brighton.
Creak, Rev. Albert, Brighton.
Creasy, Professor, London.
Drummond, Rev. S. R., Brighton.
Garbett, Rev. Archdeacon, Clayton.
Griffith, Rev. J., Brighton.
Grix, John, East Ashling, Chichester.
Harper, W. H., Shoreham.
Hawkins, Rev. E. C., Brighton.
Howell, James, Brighton.
Jardine, Rev. Dr., Brighton.
Johnstone, Rev. H. I., Brighton.
King, Dr. Wm., Brighton.
King, W. G., Brighton.
Long, Prof. Geo., Brighton.
Lower, M. A., Lewes.
Merrifield, Fred., Brighton.
Morris, Rev. Dr., Brighton.
Newton, Rev. J., Brighton.
Olding, William, Brighton.
Otter, Rev. Archdeacon, Cowfold.
Paris, George De, Brighton.
Penley, M., Brighton.
Peto, John, Brighton.
Phillips, M. L., Brighton.
Phillips, Barclay, Hon. Sec., Brighton.
Ricardo, Moses, Brighton.
Rickards, P. S., Brighton.
Rock, James, Mayor of Hastings.
Savage, W. D., Brighton.
Sleight, Wm., Brighton.
Smithe, Wm. Forster, Brighton.
Turrell, H. S., Brighton.
Wonfor, T. W., Brighton.
Wright, Robert, Lancing.

EXAMINATIONS, 1858.

The following papers, set at the Society's Final Examinations, in May last, are concluded from page 554 :—

ENGLISH LITERATURE.—CHAUCER.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. Write in modern English the following passage :—

A good wif was ther of beside Bathe,
But she was som del defe, and that was scathe.
Of cloth making she hadde swiche an haunt,
She passed hem of Ipres, and of Gaunt.
In all the parish wif ne was ther non,
That to the offring before hire shulde gon,
And if ther did, certain so wroth was she,
That she was out of alle charitee.
Hire coverchiefs weren ful fine of ground ;
I dorste swere, they weyeden a pound ;
That on the Sonday were upon hire hede.
Hire hosen weren of fine scarlet rede,
Ful streite yteyed, and shoon ful moist and newe.
Bold was hire face, and fayre and rede of hew.
She was a worthy woman all hire live,
Housbondes at the chirche dore had she had five,
Withouten other compagnie in youthe.
But therof nedeth not to speke as nouthe.
447—464.

2. Mark the feet. Can you give any rules for the pronunciation of the final *e* ?

3. Give Chaucer's declension of the words *he* and *she*, both singular and plural ?

4. Write out as much as you can of the description of the Persone in the words of the original.

5. Explain the words :—Chevalrie, arwes, couthe, coude, sote, yaf, purfiled, yeddinges, swiche, limitour, pense, gat-tothed, lewed, achatours, adradde, arette, o, unces, wood, digne, barres.

6. Give all the parts of the verb "to be" that you find in Chaucer.

7. Explain the phrases, "at your aller cost ;" "fayn wolde I do you mirthe and I wiste how ;" "and have a thank and yet a cote and hood ;" "and yet this manciple sette hir aller cappe ;" "he was not worldly to have an office."

Division II.

1. Give an account of Chaucer's life, and some notice of the author whom he is said to have imitated.

2. Write in modern English the following passage :—

At Alisandre he was whan it was wonne.
Ful often time he hadde the bord begonne,
Aboven alle nations, in Pruce.
In Lettowe hadde he reysed and in Ruce,
No cristen man so ofte of his degre.
In Gernade at the siege eke hadde he be
Of Algesir, and ridden in Belmarie.
At Leyes was he, and at Satalie,
Whan they were wonne ; and in the Grete see
At many a noble armee hadde he be.
At mortal batailles hadde he ben fiftene,
And foughten for our faith at Tramissene
In listes thries, and ay slain his fo. 51—63.

3. Give the situation of the places mentioned above, and explain the historical allusions.

4. Give instances of sarcasm in this Prologue.

5. Write out the description of the Squire. What was the difference in social rank between him and the Frankelein ?

SPENSER.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. Write in prose order and in modern English the following :—

Thou, wretched man, of death hast greatest need,
If in true ballaunce thou wilt weigh thy state ;
For never Knight, that dared warlike deed,
More luckless dissaventures did amate :
Witnes the dungeon deepe, wherein of late
Thy life shutt up for death so oft did call ;
And though good lucke prolonged had thy date,
Yet death then would the like mishaps forestall,
Into the which hereafter thou maist happen fall.

Why then doest thou, O man of sin, desire
To draw thy dayes forth to their last degree ?
Is not the measure of thy sinfull hire
High heaped up with huge iniquitee,
Against the day of wrath, to burden thee ?
Is not enough, that to this Lady mild
Thou falsed hast thy faith with perjuree,
And sold thy self to serve *Duessa* vild,
With whom in all abuse thou hast thy selfe defild ?
Book I. *Canto* IX. 45, 46.

2. Explain the allusions in this passage to the previous part of the Book.

3. Give the substance of the description of the palace of Lucifera.

4. What is the meaning of the words :—Preace, tho, yplight, ydrad, aread, canon, make (the noun), seely, portesse, stowre, darrayne, prowest, gree, hurtlen ?

5. Mention the most striking similies in the First Book.

6. Compare the accounts of Lucifera, and Orgoglio, and explain the meaning symbolized by each.

7. Describe the metrical construction of Spenser's stanza.

8. Write out the description of Arthur, as nearly as you can in the words of the original.

Division II.

1. Give a short account of Spenser's life.

2. What fault is inherent in the Allegory on which the Faery Queen is founded ?

3. From what source does Spenser derive his peculiar metre ?

4. What was Spenser's plan for his whole poem ? And how much of it is executed ?

5. Mention any imitations of Chaucer by Spenser, or of Spenser by later poets.

SHAKESPEARE.

THREE HOURS ALLOWED.

Division I.

1. Explain the following passages, giving the context in which each occurs, and mentioning any various reading :

Thou, nature, art my goddess ; to thy law
My services are bound. Wherefore should I
Stand in the plague of custom ; and permit
The curiosity of nations to deprive me,
For that I am some twelve or fourteen moonshines
Lag of a brother ?

I must change names at home, and give the distaff
Into my husband's hands.

That nature which contemns its origin
Cannot be bordered certain in itself.

For this business,
It touches us as France invades our land
Not bolds the king.

2. Write the character of Edgar in King Lear, supporting your description by references or quotations.

3. Give the plot of the concluding Act.

4. Explain the following passages, giving the context in which each occurs, and mentioning any variation in the reading:—

For the apparel oft proclaims the man;
And they in France of the best rank and station
Are of a most select and generous chief in that.

Do not believe his vows; for they are brokers;
Not of the eye which their investments show.

Marry, sir, here's my drift,
And, I believe, it is a fetch of warrant.

Pray God, your voice, like a piece of uncurrent gold
be not cracked within the ring.

That monster, custom, who all sense doth eat,
Of habits devil, is angel yet in this,
That to the use of actions fair and good
He likewise gives a frock or livery.

He, being remiss,
Most generous, and free from all contriving,
Will not peruse the foils.

5. Describe the character of Laertes.

6. Trace the steps by which the Ghost is introduced into the play, and describe the part that he plays.

7. Explain the following passages, giving the context in each case, and mentioning any various readings:—

For when my outward action doth demonstrate
The native act and figure of my heart
In complement extern, 'tis not long after
But I will wear my heart upon my sleeve
For daws to peck at.

Whereof by parcels she had something heard,
But not intentively.

One that excels the quirks of blazoning pens,
And in the essential vesture of creation
Does tire the ingener.

Exchange me for a goat,
When I shall turn the business of my soul
To such exsufflicate and blow'd surmises,
Matching thy inference.

How have I been been behaved, that he might stick
The small'st opinion on my least misuse.

8. Describe the steps by which Iago works out his purpose of deceiving Othello.

Division II.

1. From what sources is Shakespeare supposed to have obtained the materials of his plots for Othello, King Lear, and Hamlet?

2. Compare the characters of Kent and Gloster in King Lear.

3. What supernatural machinery does Shakespeare use? Compare his use of Heathen Mythology with Milton's.

4. What dramatists of note preceded Shakespeare? Did he ever copy any of them?

5. How far is a dramatic poet bound to satisfy our notions of justice? Examine with this view the conclusion of King Lear. Does the moral effect of a play depend on its representing good as always triumphant?

6. Compare the three heroines of these tragedies. Examine how far each character is adapted to the interest attached to it in the play.

7. What is Shakespeare's object in interweaving comic scenes and characters into his tragedies? Mention any instance that you remember, and comment upon it in detail.

BACON.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. How does Bacon prove that the Syllogism is not sufficient for the investigation of Nature?

2. Mention any remarkable instances of the *Idola specus*. Under which head will common superstitions fall? And under which common rumours?

3. Distinguish accurately between *Idola tribus* and *Idola fori*, and give instances to illustrate your distinction.

4. Explain what Bacon means by saying that a recurrence to final causes has corrupted philosophy.

5. What does Bacon say of the different philosophical effects produced by the systems of Aristotle and of Plato? What does he mean by comparing empirical philosophers to ants, dogmatical to spiders?

6. By what instances does Bacon attempt to show that there is hope for science in the hidden powers of nature?

Division II.

1. Give a sketch of the scheme of which the Novum Organum was intended to be a part.

2. Give instances of Bacon's remark that men prefer saving their axioms by some frivolous distinction to mending them.

3. What is the difference between *lucifera* and *fructifera experimenta?* Give instances of both kinds, and show that in the end the *lucifera* are also *fructifera.*

4. Give some account of that philosophy of the Schoolmen which Bacon's system was intended to overthrow.

5. Give a sketch of the state of science when Bacon wrote.

6. Bacon says, that "Forms are the figments of the human mind, unless we may call the laws of the action of matter by the name of forms." Explain what is meant here by the word forms.

7. What did the Schoolmen mean by occult qualities? How much truth was wrapped up in this phrase? Illustrate your answer by instances.

MILTON.

ONE HOUR AND A HALF ALLOWED.

1. Explain the following passages, giving the context in each case:—

They left me then when the grayhooded even,
Like a sad votarist in palmer's weed,
Rose from the hindmost wheels of Phœbus' wain.

I have often heard
My mother Circe with the Sirens three
Amid the flowery kirtled Naiades,
Culling their potent herbs and baleful drugs;
Who as they sung would take the prisoned soul
And lap it in Elysium; Scylla wept
And chid her barking waves into attention,
And fell Charybdis murmured soft applause.

Not that Nepenthes which the wife of Thone
In Egypt gave to Jove born Helena.

And what if seventh to these
The planet earth, so steadfast though she seem,
Insensibly three different motions move?
Which else to several spheres thou must ascribe,
Moved contrary to thwart obliquities,
Or save the sun his labour, and that swift
Nocturnal and diurnal rhomb suppos'd,
Invisible else above all stars, the wheel
Of day and night. *Paradise Lost*, viii

Spot more delicious than those gardens feigned
Or of revived Adonis, or renouned
Alcinous, host of old Laertes' son;
Or that not mystic where the sapient king
Held dalliance with his fair Egyptian spouse.

As when two polar winds blowing adverse
Upon the Cronian sea, together drive
Mountains of ice that stop the imagined way
Beyond Petsora eastward, to the rich
Cathaian coast.

2. Give the argument of the eleventh Book of Paradise Lost.
3. Write out, as nearly as you can in the words of the original, Milton's description of the first day's creation.
4. Explain the following words, and quote, where you can, lines in which they occur:—purfled, crisped, soothest, bolt (verb), bosky, empyrean, Pegasean, epicycle, maugre, budge, emprise, welkin.
5. By what argument does Milton make the serpent persuade Eve, and Eve persuade Adam?
6. What distinction of character is maintained between the two brothers in Comus?

Division II.

1. Give a short account of the life of Milton and of the date and occasion of each of his writings.
2. Mention any critics who have written on Milton's poems and the tenor of their criticisms.
3. What rules of metre does Milton observe? Quote passages to show the variety of his rhythm.
4. Quote instances of unusual grammatical constructions. State in each case, if you can, the source from whence he obtained them.
5. Quote any allusions that occur in the Paradise Lost to Milton's personal history, or to the events of the day.
6. Compare the different angels in Paradise Lost, and point out the distinctions in their several characters.

POPE.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. Explain the following passages, giving the context in each case:—

When the dull ox, why now he breaks the clod,
Is now a victim, and now Egypt's god.

Reason the card, but passion is the gale.

The fiery soul abhorred in Catiline,
In Decius charms, in Curtius is divine.

See Falkland dies the virtuous and the just:
See godlike Turenne prostrate on the dust:
See Sidney bleeds amid the martial strife.

Heroes are much the same, the point's agreed,
From Macedonia's madman to the Swede.

To all beside as much an empty shade
An Eugene living, as a Cæsar dead:
Alike or when or where they shone or shine,
Or on the Rubicon or on the Rhine.

2. Describe Pope's theory of the Master or Ruling passion.
3. What comparison does Pope make between Reason and Instinct?
4. What is Pope's account of the origin of Civil Government?
5. Write out, in the words of the original, the ironical command in the opening of the second Epistle, bidding man attempt all knowledge. Explain the allusions in the passage.
6. Mention any lines in the Essay on Man which have become common quotations, and give the context in which each occurs.

Division II.

1. In what sense is it true that Pope is a very correct poet?
2. What kind of influence did Pope exert on succeeding writers? How far was that influence different from that of Dryden?
3. From whom is Pope said to have obtained the theory on which the Essay on Man is founded? What are the obvious objections to that theory?
4. Point out real or apparent inconsistencies in the Argument, and, when possible, defend the Poet from the charge.
5. It has been said that the Essay on Man tends to the denial of a future state. Examine this statement.
6. Mention and characterize the most remarkable Poets that have directly imitated Pope.
7. Describe briefly Pope's other writings.

BURKE.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. Narrate the historical facts which justify the following statements:—

The Babylonian, Assyrian, Median, and Persian monarchies must have poured out seas of blood in their formation and in their destruction.

The kings of Syria and of Egypt, the kings of Pergamus and Macedon, without intermission worried each other for above two hundred years.

What an Aceldama, what a field of blood Sicily has been in ancient times!

Denmark sought a refuge from the oppression of its nobility in the stronghold of arbitrary power.

Athens was the city which banished Themistocles, starved Aristides, forced into exile Miltiades, drove out Anaxagoras, and poisoned Socrates.

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2. Give the arguments which Burke founds on the state of the law to prove the mischief of artificial society.
3. Give the substance of Burke's account of the Passion of Sympathy.
4. "I know of nothing sublime, which is not some modification of power." How does Burke illustrate this position?
5. What qualities does Burke consider to make up our notion of Beauty? Give his argument in regard to any one of them.
6. Give the substance of Burke's examination of Locke's opinion concerning darkness.
7. What does Burke remark on the effect of Words?
8. Mention Burke's objections to the project of giving Representatives to our American provinces.
9. What does Burke say on the maxim, "Not men, but measures?"
10. Write out, as nearly as you can in the words of the original, the peroration of the Reflections on the Revolution in France.
11. What was Necker's project for regulating the French finances? What are Burke's remarks on that project?

12. On what basis did the French Revolutionists, according to Burke, propose to rest their constitution? Give Burke's argument against their plan.

Division II.

1. Give a sketch of Burke's life, and a short account of his writings, and mention the names of his most distinguished Literary and Political contemporaries.
2. What is the purpose of the Vindication of Natural Society? Would the argument be always effectual?
3. What other theories of the nature of Beauty have been proposed? And by whom? Compare any one of them with that advocated by Burke.
4. Mention the most remarkable characteristics of Burke's style? and illustrate your answer by quotations.
5. Quote striking similes or other figures of that kind from Burke's writings.
6. How far can it be said that the progress of the French Revolution changed the tenor of Burke's political sentiments? What effect had that Revolution on other great minds that witnessed it?
7. What was the nature of the French Parliament abolished by the Revolution? To what purpose would Burke have had them applied? Is there anything similar in our own constitution.
8. How far have Burke's anticipations in regard to France been realized since he wrote?

WORDSWORTH.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. Illustrate the following passage by a short account of the mythology and histories to which it refers:—

With unrivalled skill,
As nicest observation furnished hints
For studious fancy, did his hand bestow
On fluent operations a fixed shape;
Metal or stone, idolatrously served.
And yet—triumphant o'er this pompous show
Of Art, this palpable array of Sense,
On every side encountered; in despite
Of the gross fictions chanted in the streets
By wanding Rhapsodists; and in contempt
Of doubt and bold denial hourly urged
Amid the wrangling Schools—a Spirit hung,
Beautiful Region! o'er thy Towns and Farms,
Statues and Temples, and memorial Tombs.

2. Narrate the story of Ellen from the "Churchyard among the Mountains."
3. Give the argument of "Despondency corrected."
4. Write out, as nearly as possible in the words of the original, the description of the Raven, heard as she flies across the valley in which the Solitary was dwelling.
5. Explain the allusions in the following:—

Egyptian Thebes,
Tyre by the margin of the sounding waves,
Palmyra, central in the Desert, fell;
And the Arts died by which they had been raised.
—Call Archimedes from his buried Tomb
Upon the plain of vanished Syracuse,
And feelingly the sage shall make report
How insecure, how baseless in itself,
Is the Philosophy whose sway depends
On mere material instruments.

6. Give the substance of the comparison made by the Poet between the manufacturing and agricultural life.
7. Write out or give the substance of any remarkable description of scenery that you may remember in the "Excursion." What are the chief characteristics of Wordsworth's descriptions of scenery?
8. Describe the feeling said to have been excited by the beginning and progress of the French Revolution.
9. Wordsworth rarely uses similes. Quote any that you can remember.

Division II.

1. Wordsworth is said to be sometimes prosy. Explain what is meant by this. Give instances; and examine how much, if any, truth there is in the charge.
2. What is Wordsworth's avowed principle in regard to poetic diction? Give instances in which he seems to have carried it too far. Give instances in which he seems to have himself transgressed it.
3. What critics have attacked Wordsworth in prose or poetry? And what has been the tenor of their criticism?
4. Give a classified list of Wordsworth's writings, and remark upon the difference observable between his later and earlier poetry.
5. What is the moral purpose of the "Excursion?" And how far is it attained?
6. Describe the view seen by the Solitary after the search for the man lost in the mountains. What is the purpose with which it is introduced here by the Poet?

BUTLER.

ONE HOUR AND A HALF ALLOWED.

Division I.

1. By what argument does Butler establish the immortality of the soul?
2. On what basis does Butler discuss the question of necessity? Point out the advantage of choosing such a basis.
3. How far does a belief in the moral government of God go beyond a belief in his government by Rewards and Punishments? If the latter be established, what additional proof is needed to establish the former?
4. What use does Butler make of the limited scope of our faculties as an argument in favour of religion?
5. What objections does Butler anticipate as likely to be made against his whole argument? And how does he answer them?
6. How does Butler answer the presumption from Analogy against miracles?
7. Explain the distinction which Butler draws between self-love and the particular passions.
8. How does Butler answer the objection to his system, that vice is as natural as virtue?
9. Give Butler's proof that conscience is a faculty superior in kind to the other faculties.

Division II.

1. What objection may be made to the very groundwork of the Analogy? And how would Butler answer it.
2. How does Butler deal with the supposed case of a man convinced that virtue does not really tend to happinesss, or vice to misery? And how does he contrast his system with that of Shaftesbury in this respect?
3. Butler alludes in his preface to the Epicurean system of Philosophy. Give an account of that system. What modern writers belong more or less to the same school?
4. What answer might be made to Butler's argument for the indivisibility of the soul? And what to his inference thence drawn of the immortality of the soul?
5. What other English writers on morals may be considered as followers or as opponents of Butler?
6. Is conscience considered by Butler as a moral or an intellectual faculty? What philosophical advantage is gained and what lost by his determination of this point?

LATIN AND ROMAN HISTORY.

THREE HOURS ALLOWED.

Candidates are not allowed to work more than *two* out of the *four* Sections into which this Paper is divided, and are not expected to answer more than six questions in Section III. or IV.

Section I.

Translate literally into English prose:—

Nunc, Patres conscripti, ego mea, video, quid intersit. Si eritis secuti sententiam C. Cæsaris: quoniam hanc is in republica viam, quæ popularis habetur, secutus est, fortasse minus erunt, hoc auctore et cognitore hujusce sententiæ, mihi populares impetus pertimescendi: sin illam alteram; nescio, an amplius mihi negotii contrahatur. Sed tamen meorum periculorum rationes utilitas reipublicæ vincat. Habemus enim a C. Cæsare, sicut ipsius dignitas et majorum ejus amplitudo postulabat, sententiam, tanquam obsidem perpetuæ in rempublicam voluntatis. Intellectum est, quid intersit inter lenitatem concionatorum et animum vere popularem, saluti populi consulentem. Video de istis, qui se populares haberi volunt, abesse non neminem, ne de capite videlicet civium Romanorum sententiam ferat. Is et nudiustertius in custodiam cives Romanos dedit, et supplicationem mihi decrevit, et indices hesterno die maximis præmiis affecit. Jam hoc nemini dubium est, qui reo custodiam, quæsitori gratulationem, indici præmium decrevit, quid de tota re et causa judicarit.

1. Parse fully, auctore—pertimescendi—negotii—concionatorum—videlicet—hesterno.
2. Account for the mood of vincat—intersit—ferat—judicarit.
3. Give the perfect, supine, and infinitive of co—gaudeo—fero—edo.
4. Explain briefly—

Patres conscripti.
Populares.
De capite sententiam ferat.
Supplicationem.
Quæsitori.

Section II.

Translate into English prose:—

Hæc dum Dardanio Æneæ miranda videntur,
Dum stupet, obtutuque hæret defixus in uno,
Regina ad templum, forma pulcherrima Dido,
Incessit, magna juvenum stipante caterva.
Qualis in Eurotæ ripis, aut per juga Cynthi
Exercet Diana choros, quam mille secutæ
Hinc atque hinc glomerantur Oreades; illa pharetram
Fert humero, gradiensque deas supereminet omnes;
Latonæ tacitum pertentant gaudia pectus:
Talis erat Dido, talem se læta ferebat
Per medios, instans operi regnisque futuris.
Tum foribus divæ, media testudine templi,
Sæpta armis, solioque alte subnixa, resedit.
Jura dabat legesque viris, operumque laborem
Partibus æquabat justis, aut sorte trahebat.

1. Parse fully, giving the rules of Syntax where necessary, Æneæ—miranda—forma—stipante—gradiens—ferebat—operi—subnixa—sorte.
2. Conjugate the verbs from which we have, videntur—hæret—supereminet—instans—resedit—trahebat.
3. Decline the pronoun *se*; and state the difference between the following:—

Sui amicus.
Ejus amicus.
Suus amicus.

4. What is meant by a deponent verb? What peculiarity is there in its participles? Give examples.

Section III.

1. What events in Roman History are connected with the following dates, B.C. 509—451—395—366—280—264—202—146?
2. Give a short account of Servius Tullius; and describe the changes in the constitution ascribed to him.
3. Compare the *legendary* and *historical* accounts of the war with Porsena.
4. What events led to the first appointment of Tribunes of the Plebs? Describe the duties and powers of these officers.
5. Who was Spurius Cassius? Explain the object of the law which was named after him.
6. Mention the causes, and results, of the great Latin war.
7. Give the dates, and state the objects, of the

Lex Publilia.
Lex Canuleia.
Lex Hortensia.

8. Mention some of the principal incidents in the *third* Samnite war.
9. Describe the course of events in the second Punic war, after the battle of Cannæ.
10. "Ille triumphata Capitolia ad alta Corintho
Victor aget currum, cæsis insignis Achivis."
—*Æn.* vi.

Explain the allusion in this passage; and state under what circumstances, and with what results, Rome came into collision with Greece.

Section IV.

1. Mention, with dates, the chief events in Roman History in *one* of the following periods:

i. B.C. 65 to B.C. 42.
ii. B.C. 42 to B.C. 31.

2. Give an account of the troubles under the Gracchi.
3. Sketch the life of

Scipio Africanus,
Marius, *or*,
Cato, the Censor.

4. Write a short account of the Jugurthine war.
5. Describe the war with

Viriathus,
Sertorius, *or*,
Spartacus.

6. Where was Pergamus? How did it come into the possession of the Romans? Mention some of the immediate, and ultimate, results of this addition to their territories.
7. Name the members of the two Triumvirates, and mention the fate of each of them.
8. What were the chief features in the legislation of Sylla? State the objects which he professed to have in view.
9. What was the extent of the Roman dominions at the death of Augustus? How were the Roman provinces governed?
10. Gibbon describes the system of imperial government, under Augustus, as "an absolute monarchy disguised by the forms of a commonwealth." Examine, and explain this statement.

FRENCH.

THREE HOURS ALLOWED.

I.

Translate into English *any two, and not more than two,* of the following extracts; and answer (in French if possible) the questions respectively appended to each of those two extracts.

(1.) From Pascal's *Lettres Provinciales* (Lettre V):—

Ils (les Jésuites) ont assez bonne opinion d'eux-mêmes pour croire qu'il est utile et comme nécessaire au bien de la religion que leur crédit s'étende partout, et qu'ils gouvernent toutes les consciences. Et, parce que les maximes évangéliques et sévères sont propres pour gouverner quelques sortes de personnes, ils s'en servent dans ces occasions où elles leur sont favorables. Mais comme ces mêmes maximes ne s'accordent pas au dessin de la plupart des gens, ils les laissent à l'égard de ceux-là, afin d'avoir de quoi satisfaire tout le monde. C'est pour cette raison qu'ayant affaire à des personnes de toutes sortes de conditions et de nations si différentes, il est nécessaire qu'ils aient des casuistes assortis à toute cette diversité.

1. Give a biographical sketch of Pascal: name his principal works.
2. State what you know of the *Lettres Provinciales;* explain the title and object of the work, its style and spirit, and the effect which it produced when first published.

(2.) From Racine's *Britannicus* (Acte IV. Scène 3):—

Néron. Je ne vous flatte point, je me plaignais de vous,
Burrhus; je vous ai crus tous deux d'intelligence;
Mais son inimitié vous rend ma confiance.
Elle se hâte trop, Burrhus, de triompher:
J'embrasse mon rival, mais c'est pour l'etouffer.

Burrhus. Quoi, Seigneur!
Néron. C'en est trop; il faut que sa ruine
Me délivre à jamais des fureurs d'Agrippine:
Tant qu'il respirera, je ne vis qu'à demi,
Elle m'a fatigué de ce nom ennemi;
Et je ne prétends pas que sa coupable audace
Une seconde fois lui promette ma place.

Burrhus. Elle va donc bientôt pleurer Britannicus?
Néron. Avant la fin du jour je ne le craindrai plus.
Burrhus. Et qui de ce dessein vous inspire l'envie?
Neron. Ma gloire, mon amour, ma sûreté, ma vie.
Burrhus. Non, quoi que vous disiez, cet horrible dessein
Ne fut jamais, seigneur, conçu dans votre sein.

1. Give a biographical sketch of Racine, with the names of his principal plays.
2. Explain briefly the plot of *Britannicus.*

(3.) From Molière's *Bourgeois Gentilhomme* (Acte II. Scène 6):—

M. Jourdain. Ah! monsieur, je suis fâché des coups qu'ils vous ont donnés.

Le Maître de Philosophie. Cela n'est rien. Un philosophe sait recevoir comme il faut les choses; et je vais composer contre eux une satire du style de Juvénal, qui les déchirera de la belle façon—Laissons cela. Que voulez-vous apprendre?

M. Jourdain. Tout ce que je pourrai; car j'ai toutes les envies du monde d'être savant; et j'enrage que mon père et ma mère ne m'aient pas fait bien étudier dans toutes les sciences, quand j'étais jeune.

Le Maître de Philosophie. Ce sentiment est raisonnable; *nam, sine doctrina, vita est quasi mortis imago*—Vous entendez cela, et vous savez le latin, sans doute?

M. Jourdain. Oui; mais faites comme si je ne le savais pas. Expliquez-moi ce que cela veut dire.

Le Maître de Philosphie. Cela veut dire que, sans la science, la vie est presque une image de la mort.

M. Jourdain. Ce latin-là a raison.

Le Maître de Philosophie. N'avez-vous point quelques principes, quelques commencements des sciences?

M. Jourdain. Oh! oui, je sais lire et écrire.

Le Maître de Philosophie. Par où vous plaît-il que nous commencions? Voulez-vous que je vous apprenne la logique?

M. Jourdain. Qu'est ce que c'est que cette logique?

Le Maître de Philosophie. C'est elle qui enseigne les trois opérations de l'esprit.

* * * * * * * * * * *

M. Jourdain. Voilà des mots qui sont trop rébarbatifs. Cette logique-là ne me revient point. Apprenons autre chose qui soit plus joli.

Le Maître de Philosophie. Voulez-vous apprendre la Morale.

M. Jourdain. La morale?

Le Maître de Philosophie. Oui.

M. Jourdain. Qu'est ce qu'elle dit, cette morale?

Le Maître de Philosophie. Elle traite de la félicité, enseigne aux hommes à modérer leurs passions, et......

M. Jourdain. Non; laissons cela. Je suis bilieux comme tous les diables, et il n'y a morale qui tienne: je me veux mettre en colère tout mon soûte, quand il m'en prend envie.

1. Give a biographical sketch of Molière, with a list of his works.
2. Explain the plot of the *Bourgeois Gentilhomme.*

(4.) From Boileau's *Lutrin* (Chant 1):—

La Discorde, à l'aspect d'un calme qui l'offense,
Fait siffler ses serpents, s'excite à la vengeance:
Sa bouche se remplit d'un poison odieux,
Et de longs traits de feu lui sortent par les yeux.
Quoi! dit-elle d'un ton qui fit trembler les vitres,
J'aurai pu jusqu'ici brouiller tous les chapitres,
Diviser Cordeliers, Carmes et Célestins;
J'aurai fait soutenir un siège aux Augustins;
Et cette église seule, à mes ordres rebelle,
Nourrira dans son sein une paix éternelle!
Suis-je donc la Discorde? et, parmi les mortels
Qui voudra désormais encenser mes autels?
A ces mots d'un bonnet couvrant sa tête énorme,
Elle prend d'un vieux chantre et la taille et la forme;
Elle peint de bourgeons son visage guerrier,
Et s'en va de ce pas trouver le trésorier.

1. Give a biographical sketch of Boileau; name his principal works.
2. Explain the subject of the *Lutrin*, and also the names of Cordeliers, Carmes, Célestins, and Augustins, introduced in the above passage.

(5.) From Guizot's *Histoire de la Civilisation en Europe* (Leçon I):—

Il n'est presque aucune grande idée, aucun grande principe de civilisation qui, pour se répandre partout, n'ait passé d'abord par la France.

C'est qu'il y a dans le génie français quelque chose de sociable, de sympathique, quelque chose qui se propage, avec plus de facilité et d'énergie que le génie de tout autre peuple: soit notre langue, soit le tour de notre esprit, de nos mœurs, nos idées sont plus populaires, se présentent plus clairement aux masses, y pénètrent plus facilement; en un mot, la clarté, la sociabilité, la sympathie sont le caractère particulier de la France, de sa civilisation, et ces qualités la rendaient éminemment propre à marcher à la tête de la civilisation Européenne.

Lors donc qu'on veut étudier l'histoire de ce grand fait, ce n'est point un choix arbitraire ni de convention, que de prendre la France pour centre de cette étude; c'est au contraire se placer, en quelque sorte, au cœur de la civilisation elle-même, au cœur du fait qu'on veut étudier.

1. State what you know of M. Guizot's literary career; name his principal works.
2. Explain as fully as possible the meaning which M. Guizot attaches to the word *Civilization.*

II.

1. Mention briefly, with dates, the most important events of the reigns of Clovis and Charlemagne.
2. Explain the following historical expressions: *Loi salique, Capitulaires de Charlemagne, Etats-généraux, Pragmatique sanction* (Charles VII), *Edit de Nantes, Serment du Jeu du Paume.*

III.

1. This sentence, *Je crains qu'elle ne se soit foulé le poignet*, suggests seven different remarks, as compared with the English, *I fear she sprained her wrist.* What are those remarks, each of which bears upon an important point of the French syntax?

2. Mention with examples the cases when the English *to be* must be changed into *avoir* in French, and also when *to have* must be changed into *être.*

3. Write a letter in French, of about twenty lines, upon any subject you please, with as many idiomatic expressions as possible.

GERMAN.

THREE HOURS ALLOWED.

Section I.

Translation from German into English:—Every Candidate is expected to translate one of the two following passages; and to answer a few of the grammatical questions appended to the first.

1. Der Erfolg der Schlacht von Soor war, dass Friedrich's Absichten für die Beendigung des Feldzuges keine weiteren Hindernisse im Weg standen. Denn zu neuen Unternehmungen in Böhmen war er wenig geneigt. Ehrenhalber blieb er mit seiner Armee fünf Tage lang auf dem Schlachtfelde stehen. Dann wandte er seinen Marsch nach Trautenau, die dortige Gegend noch auszufouragiren. Von da ging er nach Schlesien zurück, dessen Boden am 19. October betreten ward. Der Marsch durch die Engpässe der Gebirge war nicht ohne Gefechte vor sich gegangen, indem die preussische Armee von leichten ungarischen Truppen umschwärmt ward; doch blieben die grösseren Verluste dabei auf Seiten der letzteren. Der Haupttheil der Armee wurde in der Gegend von Schweidnitz, unter dem Oberbefehle des Erbprinzen von Dessau, in Cantonirungsquartiere gelegt. Nachdem Friedrich erfahren hatte, dass die österreichische Armee sich in drei Haufen getrennt habe, was erwarten liess, dass auch sie Winterquartiere suchen würde, begab er sich nach Berlin.

Grammatical questions on the above.

(*a.*) In what case are Absichten, Cantonirungsquartiere, and drei Haufen?

(*b.*) Give the infinitives and past participles of standen, blieb, wandte, ging, liess, and begab.

(*c.*) Why is the nominative in the second sentence placed after the verb?—State the rule relating to it.

(*d.*) What is the past participle of ausfouragiren?

(*e.*) Why is *ward*, in the fifth sentence, placed last?

(*f.*) Why is it *ward* and not *war?*

(*g.*) Why is the participle umschwärmt used without *ge?*

(*h.*) Why is the present subjunctive *habe* employed in the last sentence, instead of the imperfect indicative, which would be used in English?

2. Mein guter Stern bewahrte mich davor,
Die Natter an den Busen mir zu legen.
Nicht die Geschicke, euer schwarzes Herz
Klagt an, die wilde Ehrsucht eures Hanses.
Nichts Feindliches war zwischen uns geshehen,
Da Kündigte mir euer Ohm, der stolze,
Herrschwüth 'ge Priester, der die freche Hand
Nach allen Kronenstreckt, die Fehde an,
Bethörte euch, mein Wappen auzunehmen,
Euch meine Königstitel zuzueignen,
Auf Tod und Leben in den Kampf mit mir zu gehn.
Wen rief er gegen mich nicht auf?
Der Priester Zungen und der Völker Schwert,
Des frommen Wahnsinns fürchterliche Waffen;
Hier selbst, im Friedenssitze meines Reichs,
Blies er mir der Empörung Flammen an.—
Doch Gott ist mit mir, und der stolze Priester
Behält das Feld nicht. Meinem Haupte war
Der Streich gedrohet, und das eure fällt!

Section II.

Translation from English into German:—Not more than ten of the following passages are to be translated by each Candidate. The answers are to be written in English or German characters, but as distinctly as possible.

1. A despot one day asked his prime minister, "What do the people say of my rule?" "Sire," answered the minister, with a significant shrug of the shoulder, "they are silent." The despot was silent too, resolved to govern henceforth for the benefit of his subjects, and not according to his fancy and caprice; and the legend says, he kept his resolution, to the happiness of all parties.

2. A Spartan king used to say, it was royal to do good to one's friends and harm to one's enemies. "It is much more royal," said some one, "to turn one's enemies into friends."

3. What was Alexander, whom we are accustomed to call the Great, a hero, or a madman?

4. Most men judge not according to the real arguments of truth, but according to prejudices; not according to the inner essential standards of good and evil, but solely according to the external appearance, according to the surface of things which strike the eye.

5. There are cases in which no time must be lost, when there must be instantaneous action, when everything depends on moments which quickly pass.

6. Laws are a protection to the good, and a terror only to the bad.

7. Whatever a man considers right, good, and just, that he must and ought to do.

8. With the weak we need no other force than their weakness.

9. A true patriot is also a good man.

10. Where we cease to distinguish, there are the limits of our knowledge.

11. Malice and craft often hide themselves behind the mask of simplicity and good nature; and good-natured weakness often does more harm than decided ill-will.

12. The moon is constantly drawn to the earth, and the earth and other planets to the sun.

13. Why do we prefer being esteemed to being loved?

14. If you cannot be the best, be at least good.

15. Intelligence and knowledge do more harm than good if they are not guided by morality.

16. Italy is the first and almost the only country which, at the very time when it has laboured to make itself again acquainted with the master-pieces of the ancient languages, has also created master-pieces in its own.

17. We all know for certain that for most losses we shall console ourselves in twenty, in ten, in two years. Why then do we not make up our minds to throw away to-day opinions which we shall throw away in twenty years? Why shall I throw away errors of twenty years standing, and not of twenty hours?

18. Having received no letters from India by the last mail, I am somewhat uneasy about my friends there.

19. Not knowing where your uncle resides, I could not write to him.

29. Is your aunt not to go to the contiment this summer?

21. She was to have gone there last February.

22. I could not have accompanied her, even if she had asked me.

23. We could not accompany them on account of our being both ill.

24. This parcel is to be sent off immediately.

25. I shall help these boys to write their exercises.

26. Have you not helped them to overcome their difficulties?

27. Without knowing a word of the language, this conceited man presumes to correct those who have spoken and written it from their youth.

28. I intended to read both the works before returning them, but it could not be done.

29. There was much talking but little doing.

30. I depend upon your sending me the dictionary

back again, as soon as you have compared it with your own.

FREE-HAND DRAWING.

FOUR HOURS ALLOWED.

The Local Boards are requested to place the following objects on a Table before the Candidates in Free-hand Drawing :—

A half-pint mug, a wine bottle, and a stone jar, put close together in a triangle.

A Geranium plant.

Candidates in Free-hand Drawing are required to make clear and distinct outlines in chalk or pencil, without indicating the shadows, of the subject given; they may use charcoal and Indian rubber, but not a rule or any instrument. A Candidate may choose either of the three following sets of subjects; and if the time will allow, there is no objection to his drawing more than one set.

MANUFACTURED ARTICLES.

1. Draw from knowledge a ball about seven inches in diameter, on a cube of four inches, the cube to be represented with one angle toward the spectator.
2. Draw the door and doorway of the room you are in.
3. Draw an open umbrella from memory.

ORNAMENTS.

1. Draw the ball as before given.
2. Draw the plant which is set before you.
3. Design a pattern from the plant which shall be suited for printing or weaving.

HUMAN FORM.

1. Draw the ball as before given.
2. Draw, from memory, an eye a nose, and a mouth, separately in profile, the size of life.
3. Draw a nude figure, from memory, about two feet high.

MECHANICAL OR GEOMETRICAL DRAWING.

THREE HOURS ALLOWED.

The drawings and constructions must be neat, distinct, and accurate ; the principles employed clearly indicated, but no verbal explanations or numerical calculations admissible.

Each Candidate must draw all his figures on one large sheet of paper.

Not more than two questions from each of the Sections A, B, C, D, may be answered by any candidate.

Five questions well solved from Section E will be held as equivalent to eight from the preceding sections.

One answer from each of A, B, C, D, with two from E, will rank next in value.

Four answers (one to a question in four different sections) are the fewest that can be admitted as constituting a satisfactory examination.

Candidates are advised to consider each question well before proceeding to the construction, and to bear in mind that distinct and accurate drawing is the important point to be attended to.

(A) PRACTICAL PLANE GEOMETRY.

1. On a line of two inches as a side, describe a regular pentagon.
2. Construct a square of 3 inches *area*, and a rectangle equal to it, having its sides as 2 : 1.
3. Draw two lines to contain an angle of 60° and a circle of two inches diameter to touch both.
4. On a line of two inches as a chord, describe the segment of a circle to contain an angle of 120°.
5. Draw the circles inscribed, and circumscribing a triangle of 3 ; 2·5 ; and 2 inches sides.
6. Draw an ellipse having its axes 3 and 2 inches.

(A) PRACTICAL SOLID GEOMETRY, OR ORTHOGRAPHIC PROJECTION.

1. Show by its plan and elevation a line 3 inches long, inclined to the plane of the paper 30°, and having one extremity half an inch from it.
2. Show the plans of three horizontal lines at 1, 2, 3 inches respectively above the plane of the paper, but lying in a plane inclined to it at 60°.
3. Draw the plan and elevation of a square of 2 inches side when two sides are inclined at 20° and 30° to the plane of the paper and one corner in it.
4. A right prism 3 inches long with a regular hexagon of ·75 inches side, rests on one edge on the paper, and one face inclined to it at 25°. Show the solid by its plan, and by an elevation on a plane having the horizontal edges inclined to it at 50°.
5. Draw the plan and elevation of a cube of 2·25 inches edge when three of its corners are at 1 ; 1·6 ; 2·75 inches above the plane of the paper.
6. A right pyramid 3·5 inches high having a regular pentagon of an inch side for its base has one corner resting on the paper and one edge vertical ; show the solid by its plan and elevation.

(C) PERSPECTIVE PROJECTION.

N.B. The plane (of projection) of the *picture* is supposed to be vertical, the place of the *eye*, or point of sight, is 6 inches in front of the plane, and 2·5 inches vertically above the horizontal plane.

1. One edge of a square of 2 inches side is in the plane of the picture, and the plane of the square is vertical, but inclined at 30° to the plane of the picture.
2. A regular hexagon of one inch side lies in the horizontal plane, one angle touches the picture and a diameter makes an angle with it of 20°.
3. A cube of 1·5 inches edge, one edge in the plane of the picture, and one face inclined to it at 20° rests on the horizontal plane.
4. A circle of 2 inches diameter lies in the horizontal plane and touches the plane of the picture.

Note.—The position, with respect to the eye, of the objects in all these four questions may be assumed at pleasure.

(D) SUBJECTS FOR DRAWINGS IN ORDINARY PLAN AND ELEVATION.

1. Design an arch of 20 feet span in stone, the arch-stones to have chamfered edges, and show how they are connected with the horizontal courses of rusticated masonry. Scale, $\frac{1}{48}$.
2. Show three courses of a brick-wall, two-and-a-half bricks thick, with the proper bond in plan and elevation. Scale $\frac{1}{12}$.
3. Draw the timber truss for a foot-bridge of 30 feet span. Scale, $\frac{1}{60}$.
4. Show how a beam of 7 by 10 inches may be best scarfed. Scale, $\frac{1}{4}$.
5. Show how the double queen post, the tie beams and struts of a roof are framed together, and the form of the iron straps or stirrups. Scale, $\frac{1}{8}$.
6. Show the mode of uniting the crank and crank-rod of any machine, or part of one. Scale, $\frac{1}{5}$.
7. Draw an octagonal nut for a two-inch screw bolt. Scale, $\frac{1}{2}$.
8. Draw a chair for a rail, with the mode of keying the rail in. Scale, $\frac{1}{3}$.

(E) QUESTIONS FOR SOLUTION FOR CANDIDATES WITH MORE THAN AN ELEMENTARY KNOWLEDGE OF GEOMETRY.

1. Draw half the cycloid generated by a point in the circumference of a circle, of 1·3 inches radius, rolling along a straight line (semi-circum. = 4·084 inches).
2. Draw three turns of a triangular-threaded screw, 3·5 inches diameter and 1·25 inches pitch.
3. Show by their plans and elevations three spheres of 1, 2, 3 inches diameter, resting on a horizontal plane, each touching the other two ; mark the points of contact.

4. A horizontal cylinder 2 inches diameter passes through a vertical one 3 inches diameter, the axis of the one being ·5 inch from the other: show the curve of intersection.

5. Determine the shadow of a sphere of two inches diameter on a horizontal plane, the inclination of the sun's rays being 50°.

6. Construct a horizontal dial for latitude 54°, showing the hour-lines from 4 A.M. to 8 P.M. (N.B. The style or gnomon may be considered as a line.)

EXTRAORDINARY LAKE IN HONDURAS.

The following description is from the pen of Mr. E. G. Squier, and was communicated originally to an American newspaper:—

One of the most interesting, but hitherto almost unknown geographical features of Central America, is the Lake of Yojoa, or Taulebé, in Honduras. It was first indicated in Bailey's map of Central America, published in 1850, in which it was laid down with five outlets, two flowing eastward into the river Humuya, two running northward and uniting to form the Rio Blanco, and one flowing westward into the Rio Sta. Barbara. It was afterwards indicated, in my own map of Honduras, in 1855, with a single outlet, the river Blanco, which I also described as flowing, for a considerable distance, through a subterranean channel. At that time I greatly distrusted the existence of two or more outlets, in different directions, although this was stoutly affirmed to exist by the natives of the country. When Lieut.-Colonel Stanton, R.E., and Mr. Amory Edwards, late Vice President of the Honduras Railroad Company, sailed for Honduras in December last, I directed their attention to this lake, with the view of ascertaining the truth concerning it. In consequence, those gentlemen visited it in February last, and made a rapid survey. The following is their report:—

"We left Comayagua on the 2nd inst., and reached Siguatepeque on the 3rd, after overcoming one of the steepest *cuestas*, I think, that I ever saw. The plain of Siguatepeque surpasses any I have ever seen in beauty. It has an elevation of 3,600 feet above the level of the sea, and is about thirty miles long, and from three to eight broad, fringed with pine trees, which sometimes encroach upon it, conveying the idea of a park. The grass which covers the plain is luxuriant, and the soil is rich. It will produce wheat, potatoes, and generally the fruits of our climate. I found the English bramble, or our blackberry, indigenous, and of the greatest perfection. We crossed this plain in a direction nearly N.W., and reached the village of Taulebé, situated in a valley, surrounded by hills, 1,800 feet above the sea. We stayed here two days, and took the road due N., reaching a large stream, which here, rising from the N. flowed W., and I was surprised to learn that it was one of the outlets of Lake Yojoa. We followed up this stream for about ten miles, through a forest of mahogany and cedar, with the sarsaparilla vine in the greatest abundance, until we came to the Rancho de los Toros, situated on a slight elevation in a swampy plain extending to the lake. At this point in the river we found several canoes sent by our mutual friend Don Francisco Pineda. We at once embarked, myself steering the boat.

"Ascending against a strong current for about half a mile, we entered the clear waters of the lake. The wind was fresh from the N., and we tied up to the shore, awaiting a change. About midnight the wind subsided, and we started up the lake due north. In five hours we reached the hacienda of the Zelayas, at Agua Azul, a point about midway through the lake, on its right or eastern shore. We stopped here two days, during which time Sergeant Finch took some fine photographic views. The hacienda is a very fine one. It derives its name from an immense spring, seventy-five feet in diameter, from which pours out a large stream, quite equal in volume to the Rio Blanco. The country here is a beautiful rolling savannah, like that near Sta. Cruz, on the road from Omoa to Comayagua. The ridges are all covered with pines. The two southern outlets of the lake, Jaitique and Sarapa, unite about fifteen miles below their point of debouchure from the lake. The latter, at a distance of two miles from the lake, enters a subterranean channel, through which it flows for upwards of a mile. The Rio Blanco, as you are aware, enters a similar channel, half a mile from the lake, through which it flows for a mile and a-half. We found by barometrical observations that the surface of the water in Lake Yojoa is 2,050 feet above the sea."

This is the first authentic account which has yet been given of Lake Yojoa. It is certainly a peculiar and most interesting feature of Honduras, and with the construction of the proposed railway, which approaches within twenty miles of its shores, must become a point of attraction to travellers and to men of science.

WOLFRAM, TUNGSTEN, PAPER, AND DESIGNERS.

The *Times* correspondent, describing the Limoges Exhibition, notices samples of wolfram obtained from St. Leonard, near Limoges, exhibited by Messrs. Kœller and Jacob, of Vienna, and several articles manufactured from a combination which they have named wolframic steel. The goods, as well as the process of manufacture, are stated to be known in this country, where M. Jacob has established, near Plymouth, a manufacture of tungstate of soda, for dye purposes, but here tungsten is a novelty. One of the applications which M. Jacob proposes is the addition of tungstic acid to porcelain, to give it a translucid appearance resembling marble.

In speaking of the paper trade in the Limousin, he refers to it as "a further illustration of the mischief that results from blind adherence to routine and a spirit of opposition to progress. Formerly, and subsequent to 1806, the banks of the Vienne were the seats of important factories. The production in these works was more than doubled in the 20 years following, and in about 1834 there were more than 30 factories in full work, producing at least 500 reams a-day. When the English machines were first introduced, the Limousin manufacturers refused to adopt them. The consequence has been that the seat of manufacture has been removed elsewhere. The three towns of Limoges, St. Leonard, and St. Junien have beheld this profitable source of trade and employment for their inhabitants almost entirely disappear. At the present day praiseworthy efforts are made to revive this branch of manufacture. Three or four new works have been erected, and straw paper, of which there are several samples in the Exhibition, is successfully made. The leather trade has suffered like vicissitudes. Thirty years ago the annual production did not equal £160,000, more than a diminution by one-half of what it did half a century previously. In 1844, the annual production was £180,000; and since then the tanning and currying trades have been still more successful."

Referring to the porcelain trade of Limoges, after stating it was not until about the beginning of the present century that the manufacture acquired any importance, and that previously to that period the kaolin and petunse were extracted from St. Yrieix and the neighbourhood, to be prepared for manufacture at Sèvres, Paris, and elsewhere, he points out the remarkable fact that for a long time the manufacturers were content with producing goods which were sent to Paris to be printed and decorated, but that about 20 years back some Americans and English established themselves at Limoges, and now considerable quantities of porcelain are not only moulded and fired, but also decorated for exportation to the United States, the Levant, and other parts of the

world. "The most important decorating works here are those of Messrs. Haviland and Co., of New York, who gained a silver medal, and to whose courtesy I was indebted for permission to visit their establishment, where, curiously enough, the leading hands are from England. Thus, while Minton, Copeland, and the manufacturers in the Potteries import French decorators, the manufacturers of French china at Limoges employ English designers and ornamentalists. Nor is this the only instance where Englishmen are employed in the same branch; for at Creil, near Paris, the chief engravers of designs are Englishmen."

GALVANIC BATTERIES.

M. Petrouchoffsky, of Kieff, in Russia, has been experimenting on the electro-magnetic forces of the various descriptions of galvanic batteries, and puts forth the following table of relative values as the result of his researches:—

1. Daniell's sulphate of copper, and dilute sulphuric acid, with amalgamated zinc	100
The same battery, with zinc not amalgamated	93
2. Daniell's sulphate of copper, and a strong solution of chloride of sodium, with amalgamated zinc	105
The same battery, with zinc not amalgamated	101
3. Daniell's, with the sulphuric acid replaced by a solution of tartrate of potash, with amalgamated zinc	105
With zinc not amalgamated	99
4. Wollaston's, with amalgamated zinc	93
5. Bunsen's, with amalgamated zinc	169
6. Bunsen's, with the carbon cylinder replaced by cast iron, with amalgamated zinc	172
7. Grove's, with amalgamated zinc	178

The effect of the amalgamation of the zinc to increase the electro-motive force is clearly shown.

M. Petrouchoffsky adds that it is impossible that the numbers arrived at by different experimenters should agree perfectly, because in operating with any one given battery there will be always some slight differences, it being absolutely necessary that the metals and liquids should be chemically pure.

SOUTH KENSINGTON MUSEUM.

During the week ending 24th July, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,726; on Monday and Tuesday (free evenings), 4,551. On the three Students' days (admission to the public 6d.), 827; one Students' evening, Wednesday, 93. Total, 9,197.

Proceedings of Institutions.

WINDSOR AND ETON.—The half-yearly meeting of the Literary, Scientific, and Mechanics' Institution was held on Monday, the 5th June last. There was a large attendance of the members. In the unavoidable absence of Captain Bulkeley, the President, John Clode, Esq., one of the vice-presidents, was called upon to take the chair. Mr. C. T. Phillips, the honorary corresponding secretary, read the minutes of the general meeting held in December last, the report of the committee for the half-year, and the auditors' balance-sheet. From these documents it appeared that the Society was in a very flourishing state, the balance in hand amounted to £40 0s. 2½d. in the savings' bank, besides £30 invested as the nucleus of a building fund, and bearing in mind that nearly £40 had been laid out in improving the premises of the Society, and that the cost of new books, periodicals, and newspapers during the past half-year had been nearly £25 more, the above statement may be considered very satisfactory. There were stated to be 35 more members than there were in the preceding June. The annual income yielded by the subscriptions was stated at £156 11s. In the library there had been several valuable additions, including Tighe and Davis's Annals of Windsor. The adoption of the report and balance sheet was carried on the proposition of Captain Wilson, R.N., and Mr. Boyce and Messrs. Hanson and Cobden respectively. It was also resolved that copies of both documents should be forwarded to H.R.H. the Prince Consort. The following gentlemen were then elected to serve on the committee, Mr. Dyson, the Rev. W. C. Bromehead, Mr. Wheeler, Mr. R. Smith, Mr. Dewe, Mr. Little, and Mr. Willmore; Mr. Turnock and Mr. Cleave were re-elected auditors. Some alterations in the rules passed at the last meeting were confirmed, and notice was given of some further additions that would be proposed at the next meeting. Several suggestions for the consideration of the committee were mentioned, particularly one, about which all present seemed unanimous, namely, that another Fête should take place with as many improvements as possible. The following votes of thanks were passed unanimously:—To the committee and officers of the Society on the proposition of the chairman and Mr. Adams; to the gratuitous lecturers and teachers of classes, proposed by Messrs. J. H. Passmore and Atkins; to the local press for their valuable services, on the proposition of Messrs. Lundy and Brooke; and to John Clode, Esq, for the manner in which he had officiated as chairman, on the proposition of Messrs. C. T. Phillips and Wheeler. After a brief speech in acknowledgment from the chairman, the meeting broke up.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 21st July, 1858.

394. Hainault Forest—Report from Mr. Charles Gore.
401. Land Transport Corps—Report from Committee.
404. Highways—Return.
433. Inland Revenue—Return.
324. Joint Stock Companies—Return.
223. Bills—New Writs (as amended in Committee, and on Re-commitment.)
224. ——— Consolidated Fund (Appropriation).

Delivered on 22nd July, 1858.

387. Divine Worship in Populous Districts—Lords' Reports.
383. Caledonian Canal—53rd Report of Commissioners.
420. County Rates (Ireland)—Report from Committee.
424. War Department—Return.
437. Land Transport Corps—Copies of Despatches.
442. River Thames—Report from Committee.
419. Metropolitan Main Drainage—Return.
225. Bills—Gaols and Houses of Correction (No. 2).
226. ——— Clerk of Petty Sessions (Ireland) (as amended in Committee and on Re-commitment).
227. ——— Militia Act Continuance (No. 2).
228. ——— Militia (Service Abroad) Act Continuance.
230. ——— Saint Mary Magdalen (Newcastle) Charity.

Delivered on 23rd July, 1858.

397. William Henry Barber's Petition—Report from Committee.

Delivered on 24th July, 1858.

201 (12). East India (Revenues, &c.)—Account.
430. Dublin Metropolitan Police—Abstract of Return.
434. British Museum—Copy of Report.
435. Jeffries' Smoke-Consuming Apparatus—Return.
436. Tottenham Court-road Accident—Return.
447. Navy (Number of Able Seamen, &c.)—Return.
449. Friendly Societies (Ireland)—Report of the Registrar.
420. County Rates (Ireland)—Report, &c., from Committee.
214. Bills—Debtors and Creditors.
231. ——— Drafts on Bankers' Law Amendment (as amended in Committtee and on Re-commitment).
232. ——— New Writs (as amended in Committee, on Re-commitment and on second Re-commitment).
Public Works (Ireland)—26th Report of the Board.

Delivered on 26th July, 1858.

451. Bray's Traction Engine—Return.
454. Slave Trade—Returns.
68 (6). Trade and Navigation Accounts (30th June, 1858).
229. Bill—Factories.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, July 23, 1858.]

Dated 5th June, 1858.

1274. W. Hooper, Mitcham, Surrey—Imp. in the manufacture of projectiles.

Dated 28th June, 1858.

1452. J. Luis, 1B, Welbeck-street, Cavendish-square—An apparatus permitting the different parts of machinery working in the water of screw vessels with wells to be examined and mended. (A com.)
1454. J. Morgan, Rotherhithe—Imp. in machinery or apparatus for manufacturing or spinning rope yarns or other yarns.
1456. J. C. Coombe, 10, Alfred-place, Newington causeway, Southwark—Imp. in the method of and apparatus for manufacturing manures from fecal and other matters.
1458. W. E. Newton, 66, Chancery-lane—An improved mode of and apparatus for making nails. (A com.)
1460. B. Young and P. Brown, Spa-road, Bermondsey—An improved method of collecting and disposing of the sewage of towns or cities.

Dated 29th June, 1858.

1464. J. Shaw, Manchester—A machine to manufacture conical paper and other bags.
1466. H. N. Nissen, 43, Mark-lane—A method of preparing paper for receiving stains or copies from letters and other writings.

Dated 30th June, 1858.

1470. W. S. Wheatcroft and J. N. Smith, Manchester—Imp. in locks, fastenings, or safeguards, making them self-acting or partially self acting.
1474. J. Petrie, jun., Rochdale—Imp. in machinery or apparatus for drying warps of yarn or thread, and woven fabrics.

Dated 1st July, 1858.

1480. T. Riddell, Carracon-terrace, Old Ford, Bow—Imp. in the construction of omnibuses, and in breaks to be applied to such and other wheel carriages.

Dated 2nd July, 1858.

1482. W. T. Smith, 21, Lincoln's-inn-fields—Imp. in and the combination of certain machinery or apparatus for winnowing, washing, sifting, and separating grain, ballast, sand, shot, minerals, and other materials.
1484. J. Morris, Broughton Copper Works, Salford—An improved construction of or improvements in the construction of copper rollers or cylinders for printing fabrics.
1488. A. V. Newton, 66, Chancery lane—Certain imp. in lamps. (A com.)
1490. T. Mellodew, J. Duxbury, and E. Layfield, Oldham—Imp. in machinery or apparatus for spinning and doubling or twining cotton and other fibrous materials.
1492. D. Le Souëf, Twickenham—An improved shaft-bearer, or tug, and an improved manner of affixing the same to the harness. (A com.)

Dated 3rd July, 1858.

1494. J. Billing, Abingdon-street, Westminster—Imp. in fire-places or stoves.
1496. C. Buhring, Great College-street, Camden-town—Imp. in apparatus for filtering liquids and other fluids containing impurities.
1498. W. Bond and T. Standing, Preston—Imp. in apparatus for churning, mixing, and stirring cream, milk, and other liquids.
1500. J. G. Jennings, Holland-street, Blackfriars, and J. Lovegrove, Victoria-park road—Imp. in water-closets, and in apparatus used in ventilating house drains or sewers.

Dated 5th July, 1858.

1506. E. Simons, Birmingham—Imp. in castors for furniture.
1508. G. J. Newbery, Straitsmouth, Greenwich—Imp. in the manufacture or production of coverings for floors, applicable also to the manufacture of table mats, and other articles or coverings.
1510. T. Woolner, Blue Pits, Lancashire—Imp. in apparatus for feeding steam boilers with water.
1512. J. Greenwood, South Audley-street—Imp. in marine propellers.

Dated 6th July, 1858.

1513. J. T. Davies, Liverpool—An improved lock. (A com.)
1515. H. Hughes, Homerton—Imp. in gauffering and crimping machines, parts of which are applicable to the manufacture of continuous belts and shutters.
1516. W. E. Newton, 66, Chancery-lane—Imp. applicable to roller blinds. (A com.)
1517. J. Davis and T. Evans, Ulverston, Lancashire—Imp. in engines to be actuated by steam, air, or gases.
1518. J. Buchanan, Port Glasgow, Renfrew, N.B.—Imp. in propelling ships, vessels, and boats.

Dated 7th July, 1858.

1519. W. A. Smith, Belper, Derbyshire—Imp. in machines for making bricks, tiles, or pipes of clay.
1520. H. C. Schiller, London—Certain improved apparatus for laying down and recovering submarine telegraphic cables.
1521. J. J. Florance, Paris—Imp. in reels or spooling wheels.
1522. P. Mercier, Paris—Imp. in the treatment of peat, and in preparing the same for fuel.
1523. J. Holland, Gibb-street, Deritend, and F. Potts, Deritend, Birmingham—Certain improvements in ornamenting metallic bedsteads, and which said improvements are also applicable to the ornamenting of other metallic surfaces.
1524. W. Clissold, Dudbridge, Gloucestershire—Improved machinery for cutting or rasping dyewoods.
1525. T. James, Saint George's-in-the-East—Imp. in treating sewage matter.
1526. G. A. B. Chick, 56, Milk-street, Leek-lane—An imp in the preparation of graphite or plumbago or black lead.
1527. G. T. Bousfield, Loughborough-park, Brixton—Imp. in apparatus for ironing linen and other fabrics. (A com.)
1528. J. D. Weston, Stour Valley Iron Works, West Bromwich—Imp. in rolling iron for the manufacture of bolts and pins.
1529. A. W. Sleigh, Mansell-villas, Wimbledon-park—Imp. in the construction of floating sea barriers, or artificial beaches, breakwaters, and batteries.

Dated 8th July, 1858.

1531. J. Marland, Glodwick, near Oldham, and J. Widdall, Abbey-hill, Lancashire—An improved self-acting hook or holder to prevent accidents in lifting, hoisting, or winding at coal pits, or other similar purposes.
1532. H. Gidlow, Atherton, Lancashire—Imp. in breaks for steam engines.
1533. J. B. Booth, Preston, and R. Ashworth, Heywood, Lancashire—Imp. in the means of stopping or retarding the progress or velocity of railway carriages.
1534. P. F. Demoulin and J. Cotelle, Paris—Imp. in treating the heavy oils obtained from the distillation of coals, schists, and other hydro-carbons.
1535. T. T. Chellingworth, West Bromwich—A high-pressure steam-engine.
1536. P. R. Hodge, 16, Chalcot-crescent, Primrose-hill—Imp. in brewing fermented liquors, and in treating materials used therein for purposes of food.
1537. R. Smith, Sheffield—An improved adjustable pipe tongs. (A com.)
1538. S. Samuels, New York—Imp. in laying submarine telegraphic cables.
1539. S. Harrison, Stanhope-street, Clare-market—Imp. in ovens.
1540. P. J. Crickmer, Borough-road—Imp. in treating the sewage of London and neighbourhood.
1541. R. G. C. Fane, Upper Brook-street—Imp. in treating sewage, and in apparatuses to be employed therein.
1542. M. Scott, 3, Stanhope-street, Hyde park-gardens—Imp. in constructing breakwaters, and other like structures.
1543. G. Collier, Halifax—Imp. in means or apparatus for the drying of wool and other fibres.
1544. G. Sampson, Bradford—Imp. in means or apparatus employed in the finishing of woven fabrics.

Dated 9th July, 1858.

1545. W. Simons, Glasgow—Imp. in or connected with ships or vessels.
1547. J. Broadley, Saltaire, near Bradford—Imp. in means or apparatus employed in weaving.
1549. C. N. Kottula, Liverpool—Imp. in the manufacture of manure.
1551. J. M. Rowan, Glasgow—Imp. in manufacturing wrought-iron wheels and bosses or centres, and in the mode of, and furnaces for, heating the same during such manufacture. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1562. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction of fire-engines and similar apparatus. (A com.)—12th July, 1858.
1641. J. V. N. S. Petrziwalsky, Pall-mall—Imp. in the manufacture of bread, and in the apparatus to be employed therein.—20th July, 1858.

WEEKLY LIST OF PATENTS SEALED.

July 23rd.

132. J. J. Welch and J. S. Margetson.
134. A. Wall.
157. T. Armitage.
173. R. Coleman.
197. E. F. Dillage.
203. J. Harrison.
287. G. L. Blyth.
300. J. E. Boyd.
688. H. Napier.
711. W. Crowley.
845. J. H. Johnson.
925. E. Hunt and H. D. Pochin.
1133. J. Adamson.

July 27th.

159. J. Bethell.
164. R. A. Brooman.
168. H. W. Hart.
169. W. Kaye and C. Kaye.
172. J. Newling.
175. T. Taylor, sen., T. Taylor, jun., H. Nelson, and H. Spencer.
180. G. Bartholomew.
184. R. A. Brooman.
185. R. A. Brooman.
186. W. J. Hay.
216. J. Welch.
238. J. Wells.
246. E. Stevens.
248. W. S. Clark.
271. A. V. Newton.
309. W. E. Newton.
341. G. Schaub.
367. W. E. Newton.
678. W. Oldfield & T. O. Dixon.
725. O. Sarony.
770. H. Bauerrichter and C. G. Gottgetreu.
809. C. Mather & H. Charlton.
930. J. H. Bennett.
1016. H. Jackson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

July 19th.

1640. H. D. P. Cunningham.

July 20th.

1655. S. J. Pittar.

July 21st.

1693. C. Schiele.

July 22nd.

1662. H. W. Ripley.
1680. R. A. Brooman.
1681. Tony Petitjean.

July 23rd.

1691. W. Weallens & G. A. Crow.

Journal of the Society of Arts.

FRIDAY, AUGUST 6, 1858.

NOTICE TO INSTITUTIONS.

In accordance with the resolution passed at the last Annual General Meeting of the Society, the Council will present to each Institution in Union a quarto copy of the Speeches and Addresses of H.R.H. the Prince Consort.

The Department of Science and Art have placed in the hands of the Council a number of copies of the "Introductory Addresses on the Science and Art Department and the South Kensington Museum," delivered there during the last session, and a copy of this work will also be presented to every Institution in Union.

In addition to the above, the Council have decided to present to each Institution copies of twenty-two lectures delivered before the Society of Arts, on the results of the Great Exhibition of 1851.

Institutions desiring copies of these works are requested either to apply for them at the Society's House, or to communicate to the Secretary of the Society of Arts the address of an agent in London to whom they may be sent.

A separate copy of the Programme of Examinations for 1859, given below, has been forwarded by post to every Institution in Union.

SPECIAL PRIZE.

The Prize of Twenty Pounds (placed at the disposal of the Council of the Society of Arts for this purpose, by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., will be awarded according to the following conditions :—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breadth must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*— It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

Competitors are desired to take notice that the Council reserve to themselves the right of withholding the prize should there be no article of sufficient merit brought under their notice.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 1st of January, 1859.

PROGRAMME OF EXAMINATIONS FOR 1859, WITH AN APPENDIX.

Notice to the Institutions.

1.—In 1856 the Society's Examinations were held in London.

2.—In 1857 they were held in London and Huddersfield.

3.—In 1858 they were held at—1. Banbury ; 2. Berkhampstead; 3. Birmingham; 4. Blackburn; 5. Bradford; 6. Brighton; 7. Bristol; 8. Greenwich; 9. Halifax (2 Local Boards); 10. Hartlepool (West); 11. Ipswich; 12. Leeds (2 Local Boards); 13. Lewes; 14. Liverpool; 15. Lockwood; 16. London (5 Local Boards): 17. Louth; 18. Lymington; 19. Macclesfield; 20. Manchester (2 Local Boards); 21. Newcastle-on-Tyne; 22. Northowram; 23. Pembroke Dock; 24. Portsmouth; 25. Salisbury; 26. Selby; 27. Sheffield; 28. Wakefield; 29. Warminster; 30. Wigan; 31. Windsor; 32. York.

4.—In 1859, and thenceforward, it is proposed to hold them simultaneously at all places, throughout the extent of the Union, where suitable arrangements can be made by the authorities of the Institutions.

5.—The Council invite the Institutions in Union to assume a large share of authority and responsibility in the management of the Examinations.

6. Bearing in mind that the Union of Institutions was formed for the purpose, not of superseding, but of promoting and supplementing, the action and self-government of those bodies, the Council have adopted the following scheme of

$\left.\begin{matrix}\text{Previous}\\ \text{Final}\end{matrix}\right\}$ Examinations by the $\left\{\begin{matrix}\text{Local Authorities.}\\ \text{Society of Arts.}\end{matrix}\right.$

Previous Examinations by the Local Boards.

7.—The Institutions in different parts of the Union are invited to appoint Local Boards, who will conduct the previous Examinations of their own Candidates, and also supervise the working of papers which the Society's Examiners will set for the Society's final Examinations.

8.—No Candidate can be admitted to the final Examination without a Certificate (see form No. 4 in Appendix) from his Local Board, that he has satisfactorily "passed" its previous Examination (*a*) in the elementary subjects specified in par. 11, 12, 13, 14, and (*b*) in the special subjects in which he wishes to be examined by the Society's Examiners.

9.—The previous Examinations must be held by the Local Boards sufficiently early in the year, to allow the results to be communicated to the Council four weeks before the 17th of May, 1859, the day fixed for the commencement of the Society's final Examinations.

10. Unreserved communications between the Society and the Local Boards will be requisite to secure to the "passes" of the various Local Boards throughout the Union such an uniformity of value as may be attainable; and it is hoped that their standard may be raised, carefully and gradually, from year to year, in order that the scope and authority of those bodies may be constantly on the increase.

11.—The previous Examinations of the Local Boards may be either oral or written, or partly oral and partly written, as each Local Board may think best suited to its locality. These Examinations are to test the handwriting and spelling of the Candidates, their knowledge of English grammar, composition, and the common rules of arithmetic, as well as their knowledge of those

special subjects in which they seek to be examined by the Society's Examiners.

12.—Handwriting.—A bold even round-hand, without loops, longtails, or flourishes, should be preferred.

13.—English Grammar and Composition.—An extract from some standard English author should be set, into which errors of spelling, grammar, and punctuation should be introduced. Some faulty grammatical constructions in common use, and vulgarisms, should be submitted for correction.

14.—Arithmetic.—A knowledge of the elementary Rules, including the Rule of Three, should be required.

Final Examination by the Society's Examiners.

15.—The names of the "passed" Candidates, and the subjects in which the Society is to examine them, must be made known to the Council four weeks before the day fixed for the Society's final Examinations. (See Time-table, Form No. 6, in Appendix.)

16.—The Society's Examiners will then set the requisite papers for the final Examination; and these will be forwarded to the Local Boards. The Local Boards will see, and certify to the Council, in the form which the Council will furnish (see Appendix, Form No. 7), that the papers are fairly worked by each Candidate, without copying from any other, and without books or other assistance; and will return the worked papers to the Council.

17.—No person who shall not have been, for three months previously, a member of, or student of a Class in, an Institution in union with this Society; no person under sixteen years of age; no graduate or undergraduate of any University of the United Kingdom; no student of any of the learned professions; no certificated schoolmaster or pupil-teacher; and no person who has not satisfactorily "passed" the previous Examination of the Local Board in 1859, is eligible for examination by the Society's Examiners. No Candidate obtaining a First Class Certificate in any subject can come up for Examination in that subject in any subsequent year.

18.—The final Examination will be conducted by printed papers.

19.—The Examiners will award Certificates of three grades, but Certificates of the first grade will be awarded only to a high degree of excellence.

20.—The final Examination will be held simultaneously, on the days, and at the hours, specified in the Time-table for 1859 (Appendix, Form No. 6.), at such places, throughout the Union, as can make satisfactory arrangements for the previous Examinations by the Local Boards, and for the supervision of the working of the papers in the final Examination by the Society's Examiners.

21.—Judgment will then be passed by the Society's Examiners, and the Awards, Prizes, and Certificates will be communicated to the parties concerned.

22.—The following is the list of subjects for the Final Examination in 1859:—

I. Arithmetic.
II. Bookkeeping, by Double Entry.
III. Algebra.
IV. Geometry and Mensuration.
V. Trigonometry.
VI. Conic Sections.
*VII. Navigation and Nautical Astronomy.
VIII. Statics, Dynamics, and Hydrostatics, Hydraulics, and Pneumatics.
IX. Practical Mechanics.
X. Magnetism, Electricity, and Heat.
*XI. Astronomy.
XII. Chemistry.
XIII. Animal Physiology.
*XIV. Botany.
*XV. Agriculture.
*XVI. Political and Social Economy.
XVII. Geography.
XVIII. English History.
XIX. English Literature.
XX. Latin and Roman History.
XXI. French.
XXII. German.
XXIII. Theory of Music.

* Each of the five subjects which are marked with an asterisk in this list was taken up by fewer than *four* Candidates in the Final Examinations in 1857 and 1858. The Council therefore give notice that in 1859 no Paper will be set by the Society's Examiners in any of those five subjects unless the Council shall be informed, before the 1st of February, 1859, that ten Candidates are preparing themselves in these subjects, for the Previous Examination.

23.—Drawing has been withdrawn from the list of subjects, not because the Council consider that Drawing is unimportant—for they are of opinion that every one ought to be taught to draw—but because the Government has provided, in all parts of the kingdom, for the Annual Examination of Candidates in Drawing; and the Council think that it would be a waste of resources for the Society of Arts to follow in the steps of the Government with similar proceedings. An account of the Government Examinations in Drawing is given in the Appendix.

24.—To guide the reading of the Candidates, and to indicate the portions of the subjects that will be taken in the Examinations, the Examiners in the several departments have set down certain text-books. But they desire it to be distinctly understood that in so doing they do not pronounce any opinion as to the comparative merit of the works named. The selection is in many cases determined by the cheapness of the book, or by its being in common use. Real knowledge, however or wherever acquired, will be accepted by the Examiners of the Society of Arts.

I.—Arithmetic.

25. Practice, Interest and Discount—Proportion, Simple and Compound—Fractions, Vulgar and Decimal. The principles of a Decimal Notation in money on the basis of the pound unit.

26. The Examiners will take into account not only the correctness of the work, but the clearness with which it is set down, and the neatness of the figures. Round, compact figures, as nearly like as possible to old fashioned printed numerals, will be preferred.

27. Any of the modern Treatises on Arithmetic, such as Hunter's Text Book (*National Society*), Colenso (*Longmans*), or Barnard Smith (*Bell & Daldy*), may be used.

II.—Bookkeeping by Double Entry.

28. Candidates should be prepared to answer questions as to the nature and use of the different books usually kept in a merchant's office. They should be prepared to journalize a series of transactions from a waste book, and, having posted the entries to the ledger, to balance the accounts, to prove them by a trial-balance, and finally to exhibit an account of profit and loss, with a balance-sheet.

29. Candidates will be required to draw the usual commercial forms, such as receipts, bills of exchange, promissory notes, invoices, account sales, accounts current, bills of parcels, and to explain the meanings of the technical terms used in general business.

30. The following books, or some of them, may be consulted:—

Book-keeping, Irish School Series. (*Groombridge.*)
Rudimentary Book-keeping. (*Weale's Series.*)
Kelly's Elements of Book-keeping. (*Simpkins & Co.*)

III.—Algebra.

31. Algebraical Fractions, Square and Cube Root, Greatest Common Measure, Least Common Multiple,

Simple and Quadratic Equations single and simultaneous, Ratio, and Variation. Candidates should be prepared to give explanations of Elementary Principles and proofs of Fundamental Propositions.

32. Colenso's Algebra (*Longmans*), or Barnard Smith's Algebra (*Bell and Daldy*), may be used with advantage.

IV.—Geometry and Mensuration.

33. Euclid, Books I, II, III, IV, VI, XI and XII. Potts' smaller edition is recommended. (*Parker.*)

34. A facility in solving geometrical theorems and problems, deducible from the first six books, will be expected on the part of those who desire to obtain high class certificates.

35. The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines. The superficial and solid contents of cones, cylinders and spheres, &c.

36. Candidates will be expected to be familiar with the different rules for measuring and estimating artificer's work, such as joiner's, bricklayer's, mason's, slater's, and plumber's work, and to be able to prepare estimates for such work from given quantities.

37. The following books may be consulted:—

Rudimentary Treatise on Mensuration. (*Weale's Series.*)

Young's Treatise on Mensuration. (*Simms and M'Intyre.*)

V.—Trigonometry.

38. In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangles, and the use of logarithmic tables.

39. Snowball's Trigonometry, (*Macmillan, Cambridge,*) Hall's Trigonometry for Schools, (*Christian Knowledge Society,*) or any of the modern treatises on Algebraical Trigonometry may be consulted. Mathematical Tables, (*Chambers' Series.*)

40. Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

VI.—Conic Sections.

41. The properties of the three curves treated geometrically. Also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

42. Drew's Conic Sections, (*Macmillan,*) or

Whewell's Conic Sections, (*Parker,*) may be consulted.

For Analytical Conics, Puckle's or Todhunter's Conic Sections.

VII.—Navigation and Nautical Astronomy.

43. A good knowledge of Plane and Spherical Trigonometry, of the definitions and terms used in Nautical Astronomy, and of the various measurements of time and their mutual conversions will be required, as well as skill in the use of logarithmic tables, and neatness, order, and accuracy, in the numerical solutions of problems. The candidate should understand the construction of charts; the nature and laws of circular storms; great circle sailing, &c. The methods of determining the latitude, longitude, variation of the compass, and error and rate of a chronometer by astronomical observations, with the demonstrations of the formulæ employed. The use of Nautical Astronomical Instruments, &c.

44. The Nautical Almanac, Riddle's Navigation and Nautical Astronomy. (*Law*, Essex-street.)

VIII.—Statics, Dynamics, Hydrostatics, Hydraulics, and Pneumatics.

45. The Properties of Matter; Force and Motion; the Mechanical Powers; Regulation of Force; the Pendulum; the Strength of Materials, &c.; the Mechanical Properties of Liquids; Specific Gravity; Mechanical Properties of Air; the Barometer; Machines for raising Water, &c.

IX.—Practical Mechanics.

46. The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

X.—Magnetism, Electricity, and Heat.

47. The following books may be consulted:—

Lardner's Handbooks of Natural Philosophy. (*Walton and Maberly.*)

Brooke's edition of Golding Bird's Elements of Natural Philosophy. (*John Churchill.*)

Herschel's Discourse on the study of Natural Philosophy (*Longmans*) for a *general* view of the subject.

XI.—Astronomy.

48. The principles of Plane Astronomy.

Herschel's Astronomy. (*Longmans.*) First chapters.

Airy's Lectures on Astronomy.

XII.—Chemistry.

49. Organic and Inorganic. Candidates will be examined in the chemistry of the metalloids and of the chief metals; the laws of combining proportions; volumes of gases and vapours, &c. They are expected to be able to explain decompositions with the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron, and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

XIII.—Animal Physiology.

50. The general principles of Animal Physiology. Practical Application of them to health, and the wants of daily life.

51. The following books are recommended:—

Carpenter's Manual. (*Churchill.*)

Lardner's Animal Physics. (*Walton and Maberly.*)

Translation of Milne Edwards's Manual of Zoology. (*Renshaw.*)

XIV.—Botany.

52. Scientific and Applied Botany. The leading principles of Morphology, Vegetable Physiology, and the Classification of Plants. The Examination will include the characters of important Natural Orders represented in the British Flora; and a knowledge of indigenous or commonly cultivated plants, having noxious or useful properties, will be required.

53. The following text-books may be used:—

Lindley's School Botany. (*Longmans.*)

Henfrey's Rudiments of Botany. (*Van Voorst.*)

Henfrey's Elementary Course of Botany. (*Van Voorst.*)

XV.—Agriculture.

54. The theory of agriculture, and such a general knowledge of farm practice, and of the management of live stock as must, to some extent, have been obtained in the field. The Examination in the theory of agriculture will include both the mechanical and the chemical aspects of the subject; on the one side the advantages and results of tillage operations, and on the other the influence and the operation of particular manures and of food. The questions in farm practice will test a knowledge of the cultivation of our most important crops, and of the management of our principal domesticated animals.

55. The following books are recommended:—

Lowe's Elements of Practical Agriculture. (*Longmans.*)

Johnston's Agricultural Chemistry. (*Blackwood and Sons.*)
Morton's Cyclopedia of Agriculture, (*Blackie and Son.*)
Stephens' Book of the Farm. (*Blackwood and Sons.*)

XVI.—Political and Social Economy.

56. Elements of Political Economy, by James Mill.
Principles of Political Economy, by John Stuart Mill.
The Phenomena of Industrial Life. Edited by the Dean of Hereford. (*Groombridge.*)
Whateley's Lectures on Political Economy. (*Parker.*)
Dr. E. R. Humphrey's Manual of Political Science. (*Longmans.*)
57. N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first class Certificate.

XVII.—Geography.

58. All candidates will be expected to possess a sound knowledge of Descriptive Geography, and in particular, of that of the British Empire. They will also be required to sketch from memory maps of any of the countries of Europe, showing the positions of the chief mountain chains, the largest rivers, and the most important towns.
59. The following are useful text books in Elementary Geography:—
Anderson's Modern Geography. (*Nelson.*)
John's Elements of Geography. (*Darton.*)
William Hughes' General Geography. (*Gleig's Series.*)
William Hughes' Geography of the British Empire. (*Gleig's Series.*)
The General Atlas. (*National Society.*)
60. Candidates for certificates of the first and second grade of merit should have a general acquaintance with Physical, Political, and Commercial Geography. The questions in the Examination Paper will give them an opportunity of showing also a deeper acquaintance with any of the following subjects:—

(*a*) Geology in its relation to Geography.
(*b*) The distribution of Plants and Animals on the surface of the globe.
(*c*) Meteorology.
(*e*) Ethnography.

61. The following text books may be recommended,
William Hughes' Manual of Geography. (*Longmans.*)
Mrs. Somerville's Physical Geography, 2 vols. (*Murray.*)
Guyot's Earth and Man. (*Parker.*)
Black's School Atlas. (*Black.*)
The School Physical Atlas, (*either that published by the National Society, or that by Keith Johnston*).
An Atlas of the Geography of the British Empire. (*National Society.*)
Page's Introductory Text Book to Geology. (*Blackwood.*)
Page's Advanced Text Book. (*Blackwood.*)
Ansted's Ancient World. (*Van Voorst.*)
Drew's Practical Meteorology.
Latham's Man and his Migrations.

XVIII.—English History.

62. A general knowledge of the outlines of English History. A special knowledge of English History from the commencement of the reign of Henry 2nd to the end of the reign of Richard 2nd.
63. Knight's English History.
Hallam's Middle Ages, chapter viii. (*Murray.*)
Creasy's Rise and Progress of the English Constitution. (*Bentley.*)

XIX.—English Literature.

64. Candidates may take up for examination any two, but not more than two, of the authors in the following list:—
Chaucer's Prologue to the Canterbury Tales.
Shakespeare. Macbeth, Richard II., Tempest.
Bacon. Essays.
Addison's Contributions to the Spectator.
Goldsmith's Poems.
65. A fair knowledge of the great writers cotemporary with the authors selected will be required for the highest Certificate.

XX.—Latin and Roman History.

66. Livy, Book xxi.
Virgil. Æneid, Book ii.
Roman History, to the death of Augustus Cæsar.
67. Liddell's History of Rome (in one volume) is recommended as a Text book.

XXI.—French.

68. Literature:—
Corneille: Le Cid.
Voltaire: Siècle de Louis XIV.
Montesquieu: Grandeur et Décadence des Romains.
Tocqueville: L'Ancien Régime et la Révolution.
Candidates may take up any two, but not more than two, of the above works.
69. History:—Sketches of the reigns of Louis VI., Louis IX., Charles VII., and Louis XIII.

XXII.—German.

70. Schiller's Geschichte des Dreissigjährigen Krieges, *or* Schiller's Wilhelm Tell.

XXIII.—Theory of Music.

71. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.
72. The Elements of Harmony.
73. Hullah's "Rudiments of Musical Grammar," and "Grammar of Musical Harmony."
74. Arrangements should be made in the Previous Examination by the Local Boards to test Candidates by oral examination in their knowledge or appreciation of the *sound* of musical successions and combinations. A form of the test to be used for this purpose by the Local Board at the Previous Examination will be sent to such Local Boards as may require it, in due time before the Examination.

LIST OF EXAMINERS FOR 1859.

1. Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
2. Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
3. Algebra	Rev. Harvey Goodwin, M.A., Cambridge.
4. Geometry and Mensuration	Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.
5. Trigonometry	William Spottiswoode, Esq., F.R.S.
6. Conic Sections	Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.
7. Navigation and Nautical Astronomy...	John Riddle, Esq., F.R.A.S., Head Master of the Nautical Schools, Greenwich.

8. Statics, Dynamics, Hydrostatics, Hydraulics, and Pneumatics	Rev. A. Bath Power, M.A., Principal of the Diocesan Training School, Norwich.
9. Practical Mechanics .	T. M. Goodeve, Esq., Professor of Natural Philosophy, King's College, London.
10. Electricity, Magnetism, and Heat ...	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
11. Astronomy	Rev. Baden Powell, M.A., F.R.S., Savilian Professor of Geometry in the University of Oxford.
12. Chemistry	A. W. Williamson, Esq., Professor of Chemistry, University College, London.
13. Animal Physiology .	William Sharpey, Esq., M.D., F.R.S., Examiner in University College, London.
14. Botany..................	Arthur Henfrey, Esq., F.R.S., Professor of Botany, King's College, London.
15. Agriculture	J. C. Morton, Esq.
16. Political and Social Economy............	Charles Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
17. Geography	Wm. Hughes, Esq., F.R.G.S., Professor of Geography in Queen's College, London.
18. English History......	E. S. Creasy, Esq., M.A., Professor of History, University College, London.
19. English Literature...	Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea.
20. Latin and Roman History.........	Rev. F. Temple, D.D., Head Master of Rugby School.
21. French	Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.
22. German.................	Dr. Bernays, Professor of German, King's College, London.
23. Theory of Music......	John Hullah, Esq.

PRIZES FOR 1859.

The following Prizes are offered to the Candidates, viz.:—

One First Prize of £5, and one Second Prize of £3 in each of the twenty-three subdivisions of the subjects of Examination.

No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

The Prizes will be given in money or in books, at the option of the Candidate.

The following Prizes are offered to the Institutions, viz. :—

To the Institution whose Candidate obtains the above-mentioned first Prize of £5 in each of the 23 Sub-Divisions of Subjects, one Prize of £5. An Institution can take more than one such Prize: but no such Prize can be taken by one Institution unless the Council of this Society are satisfied that the Candidate, in respect of whom the Prize is claimed, has received at the Institution systematic instruction in the subject for a period of not less than three months.

The following Prizes are offered to the Local Boards, viz. :—

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than ten) bear the largest proportion to its whole number of Candidates. —One Prize of £10.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than eight) bear the largest proportion to its whole number of Candidates. —One Prize of £8.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than six) bear the largest proportion to its whole number of Candidates. —One Prize of £6.

To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than four) bear the largest proportion to its whole number of Candidates. —One Prize of £4.

No Local Board can receive more than one of these Prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best, for the promotion of the objects for which it was instituted.

APPENDIX.

The following forms, that will be forwarded at the proper time next year to the Local Boards, are here published in order that the Boards may know beforehand what arrangements they will have to carry out in co-operation with the Council of the Society of Arts.

Form No. 1.

Society of Arts, Adelphi, London, W.C.

Sir,—I forward to you a return (No. 2), which I shall be obliged by your filling up and re-posting to me, as soon as possible, in order that the necessary Forms (No. 4), may be forwarded to you.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

To the Secretary, Local Board of____________________.

Form No. 2.—Return of Candidates who have attended the Previous Examinations.

____________________ Local Board,

______________, 1859.

Sir,—I beg to inform you that, on the___________ of_________*_____________Candidates underwent the Previous Examination; that †___________of these Candidates passed the Examination satisfactorily; and that †___________of them desire to present themselves at the Final Examinations. I have, therefore to beg that you will furnish me with the requisite number of the Forms (No.4.). I have entered in the margin the numbers of papers, in each subject, that will be required at the Final Examination.

I am, Sir, your obedient servant,

(Signed)____________________

Secretary, Local Board.

To P. Le Neve Foster, Esq., Secretary.

* Insert Date. † Insert Number.

Form No. 3.—Circular taking out supply of Forms No. 4 to Local Boards.

Society of Arts, Adelphi, London, W.C.

Sir,—I am directed by the Council of the Society of Arts to forward the accompanying ______ forms (No. 4) for the Candidates who are reported to have passed the previous Examination before your Local Board.

I am to request that these forms may be filled up, signed, and returned to me at your earliest convenience, as the number of papers to be prepared, and other important details of the Final Examination, cannot be settled until the returns from all the Local Boards are complete.

One of the forms now sent to you is to be filled up, partly, as you will perceive, by, and partly on behalf of, each Candidate who has passed your previous Examination. Every such Candidate must carefully remember the number entered, in red ink, at the head of the form which is given to him, as this number (and not his name) will have to be entered on each of his papers at the Final Examination, and by it alone will his work be known to the Examiners, or rearranged in the event of any accidental mixture, or displacement, of the papers. A card, bearing a number corresponding with that at the head of the form, will be sent from this office to each Candidate.

You will perhaps have the goodness to keep a list of the Candidates, with the number of each opposite his name, for reference in the case of difficulty. A copy of the list should also be hung up, in some conspicuous place, in the Examination room, which may be specially consulted by the Candidates on the days of the final Examination.

Detailed instructions (Form No. 5), as to the regulations adopted by the Council to secure uniformity and fair dealing in the arrangements for the Final Examination, will be hereafter forwarded to you. In the meantime I have only to repeat my urgent request that the forms sent to you herewith may be returned to me, duly and carefully filled up, *without delay*.

I am Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

Form No. 4.—Return of Candidates who have passed the Previous Examination.

SOCIETY OF ARTS. UNION OF INSTITUTIONS.

1. Candidate's name, in full ______
2. Age last birthday ______
3. Residence ______
4. Occupation (present or proposed) ______
5. Member of ______ Institution.
   or
6. Student of a Class in ______ Institution.
7. Number of years at school ______
8. Number of years since leaving school ______
9. Father's name ______
10. ,, occupation ______

I, the above-named ______ declare that the above returns are correct, and that I desire to present myself as a Candidate at the ensuing Examination to be held by the Society of Arts at ______.

N.B.—The above returns must be entered by the Candidate in his own handwriting.

I HEREBY CERTIFY that the above-named ______ has passed a satisfactory previous Examination in Handwriting, English Grammar, and Composition, the elementary Rules of Arithmetic, including the Rule of Three, and in the special subjects, in the margin, opposite to which I have placed my initials.

Signed ______

On behalf and by authority of the Local Board of..... ______

Dated this ______ day of ______, 1859.

To P. Le Neve Foster, Esq.

N.B.—No person who shall not have been, for three months previously to the Final Examination, a member of, or Student of a Class in, an Institution in Union with the Society of Arts; no person under sixteen years of age; no graduate or undergraduate of any University of the United Kingdom; no student of any of the learned professions; no certificated schoolmaster or pupil teacher; and no person who has not satisfactorily "passed" the Previous Examination of the Local Board, is eligible for examination by the Society's Examiners.

Form No. 5.—(Letter of Instructions.)

Society of Arts, Adelphi, London, W.C.

Sir,—I am directed by the Council of the Society of Arts to inform you that the papers for the ensuing final Examination of Candidates for the Society's Certificates will be forwarded by post, on the of , in a parcel addressed to you at ______

You will have the goodness to let me know *by telegraph* on . the , in time for the despatch of duplicate papers by that evening's post, if the parcel is not duly delivered to you in the morning of that day.

The papers in each subject will reach you in a separate envelope, the *seal of which is to be broken, in the presence of the assembled Candidates, at the commencement of the time appointed* for that subject in the Time-table. This direction, as well as the *order* and *hours* of Examination laid down in the Time-table, must be strictly observed. It is absolutely necessary, for the proper working and ultimate success of these Examinations, that there should not be the least suspicion as to the perfect fairness and equality with which they are conducted at all the different centres; and such suspicions can only be obviated by the *simultaneous* employment of the *same* set of papers at each centre. On this, and on the firmness and fidelity with which the members of the Local Board discharge the simple, though somewhat onerous, duties required of them to prevent the possibility of any dishonest dealing on the part of any Candidate while under examination, the success of the present scheme depends.

I am, therefore, to invite your most careful attention to the "Advice to Candidates" which you will find printed at the foot of the enclosed copies of the Time-table, and to the terms of the accompanying Forms of Declaration, one of which Forms will have to be filled up and returned to me, after it has been signed by at least two members of the Local Board, at the end of each meeting of the Candidates. To provide for this it will be necessary that you should immediately make arrangements with your colleagues on the Local Board, to secure the attendance of a sufficient number of them in rotation at the different periods of the Examination. The attention of your Candidates should be drawn to the Time-table now sent to you, and copies of it should be suspended in the Examination Room.

It will further be necessary that the Local Board should provide writing-paper, of foolscap size, scribbling-paper for rough drafts, and blotting-paper for the use of the Candidates, who should be desired to bring their own pens and a small inkstand to the examination room, but nothing else. They should be required, on entering the examination room, to give up all books, papers, memo-

randa, writing-books, or loose blotting-paper which they may have brought with them, under the penalty of immediate exclusion from the Examination if any such articles should thereafter be found in their possession. After such notice, the plea of accident or forgetfulness cannot be admitted.

Stationery should be supplied to each Candidate, at the rate of three sheets of foolscap, and one of scribbling paper, for every paper which he works, together with one sheet of blotting-paper, which should serve for the whole of the Examination. Ruled paper will be forwarded by me for the use of those Candidates who are to be examined in Book-keeping.

The Time-table has been drawn up to meet the general convenience of the whole number of Candidates who will assemble at the different centres.

The Candidates should sit, in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well to disregard the numerical order, and arrange alternately the Candidates who take different subjects.

Three hours only are allowed for each paper.

All writing must cease at the end of the three hours, *to a moment;* and, if there is no clock in the room, it may be well to give notice to the Candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The Candidates should leave their answers at their seats (with the Examination papers attached to them), after having carefully filed them all together in order through the upper left hand corner. A supply of silk twist and some large needles should be provided for this purpose.

The papers should then be collected—those on each subject separately—and arranged in the order of the Candidates' numbers. After a separate Declaration has been filled up and signed, in reference to the papers on each subject, it should be tied up with them; the whole set, or sets, worked each day should be forwarded on the following morning, either by post (if the numbers are small), or by railway, in *one* parcel addressed to me at this office, with an entry on the cover stating the number and subjects of the papers which it contains. The Council would also be glad if you could conveniently transmit, by the post of the same day on which each parcel is sent off, a separate letter, to announce the despatch of such parcel, and mentioning, (1) The number of papers in each subject which it contains, and (2) whether it has been forwarded by post or rail.

The Council regret to have to saddle you with the observance of so many minute directions, but, as it is impossible, in the multiplicity of particulars which a simultaneous Examination involves, to rectify any serious mistake or omission, the responsibility of every one engaged, whether in arranging or carrying out the details, becomes great in proportion.

I am, Sir,
Your obedient servant,
P. LE NEVE FOSTER, Secretary.

Form No. 6.—Time-table.

Society of Arts' Examinations.—Union of Institutions. 1859.

The Examinations will be held on the evenings of the 17th, 18th, 19th, and 20th of May, 1859.

The hours of Examination will be from six o'clock to nine.

No Candidate will be admitted after the Examinations shall have commenced.

Time Table for 1859.

Tuesday, the 17th May. From 6 to 9 p.m.	Wednesday, the 18th May. From 6 to 9 p.m.	Thursday, the 19th May. From 6 to 9 p.m.	Friday, the 20th May. From 6 to 9 p.m.
Arithmetic. Trigonometry. Magnetism, Electricity, and Heat. Agriculture. English History.	Book-keeping. Navigation and Nautical Astronomy. Conic Sections. Chemistry. English Literature. Music.	Algebra. Practical Mechanics. Astronomy. Physiology. Political Economy. French.	Geometry and Mensuration. Statics, &c. Botany. Geography. German. Latin.

No Candidate may work more than one paper in each evening.

Advice to Candidates.

1. Read over the Time-table carefully, and note the hours appointed for the subjects in which you wish to be examined. Be at your seat in the Examination Room *five minutes before the hour appointed* for each Paper which you are to work.

2. When the Paper is given to you, *first* look to the instructions printed at the head of it, and *then* read the questions carefully over, marking those which you think you can answer best. Do them first, and if any time remains, you may try some of the others, but do not exceed the number of questions appointed to be answered. Remember that a few accurate and sensible answers will gain a higher number of marks than a great number of indifferent attempts.

3. No Candidate will be allowed to resume the working of a Paper after he has once left the room in the course of the time appointed for that Paper.

4. If a Candidate has any question to ask, or wants anything in the course of the Examination, he should not leave his place; but *should stand up and call out his number*, when some one will attend to him.

5. As soon as notice is given (10 minutes before the end of the time) finish your Papers, see that they are numbered rightly, and in their proper order, and leave them UNFOLDED at your seat.

Caution.

6. No Candidate may speak to another Candidate, on any pretence whatever, under pain of immediate expulsion.

7. Any Candidate detected in taking unfair advantages, such as referring to any Book, or Written Paper, or in seeking assistance from another, will be subject to the same penalty.

8. Whoever gives assistance will be treated in the same manner as he who asks for it.

9. Stationery, including Blotting-paper, will be furnished by the Local Board for the use of the Candidates. No one can be permitted to bring anything into the Room with him, except an inkstand and a supply of such pens as he is in the habit of using.

Form No. 7.—(Declaration.)

Declaration.

Local Board of ______________

We, the undersigned, hereby declare that the _____ a papers on ______________ b which are forwarded herewith, were worked, in our presence, by the Candidates whose numbers they respectively bear, without any assistance whatever, from books, notes, memoranda, from each other, or from any other person. We declare that not more than three hours were occupied in working these papers; that they were worked at the time appointed for them in the Time table issued by the Society, and that no Candidate was allowed to resume,

(a) Insert Number. (b) Insert Subject.

or complete, a paper after having left the Examination room in the course of the time assigned to that paper; We further declare that the paper of questions given to each Candidate was taken from the envelope in which it was transmitted from the Society of Arts, the seal of this envelope being broken in our presence, and in that of the assembled Candidates, at the commencement of the time appointed for the paper in the time table issued by the Society; and, finally, we declare that not fewer than* ________ of our number were present during the whole time that the Candidates were engaged on these papers.

Name, designation, and address of members of LocalBoard who were present during the working of the papers referred to in the above declaration.† { ________
____
____
____
____
____

GOVERNMENT DRAWING EXAMINATION.

The Department of Science and Art holds an examination in drawing once in the year, in every town where there is a School of Art.

At this examination any person, of any age or sex, educated at the School or otherwise, may come up for examination and is eligible to take rewards.

In such towns the period of examinations may be learnt at the School of Art.

In places where there are no Schools of Art, provided that the names of fifty persons who will come up for examination in drawing, are sent in to the Secretary of the Department at South Kensington, arrangements will be made for an Inspector to hold such an examination; when awards of drawing Instruments, Materials, &c., are made to those who have attained a given amount of competency.

A book, entitled Elementary Drawing, is published for the Department of Science and Art by Messrs. De la Rue and Co., Bunhill-row, and Messrs. Chapman and Hall, Piccadilly, which illustrates the nature of the examination.

LITERARY AND ARTISTIC COPYRIGHT.

A Committee has been formed at Brussels, for the purpose of organising a congress to discuss the subject of Literary and Artistic Copyright. The Committee consist of the following:—

Charles Faider, ancien ministre de la Justice, avocat général à la Cour de cassation, membre de la classe des lettres de l'Académie royale, *President.*

Vervoort, membre de la Chambre des Représentants, président du Cercle artistique et littéraire de Bruxelles, *Vice-President.*

Ed. Romberg, Directeur des affaires industrielles au Ministère de l'Intérieur, *General Secretary.*

Vander Belen, Directeur de la division des lettres, sciences et beaux-arts au même département.

Baron, professeur de l'histoire de la littérature Française, á l'Université de Liége, membre de la classe des lettres de l'Académie royale.

Ed. Fetis, conservateur adjoint à la Bibliothèque royale, membre de la classe des beaux-arts de l'Académie royale.

Guillaume Geefs, statuaire, directeur de la classe des beaux-arts de l'Académie royale.

Portaels, peintre d'histoire, membre de la classe des beaux-arts de l'Académie royale.

Stallaert, homme de lettres, professeur de langue flamande à l'Athénée royal de Bruxelles.

Casier, avocat à la Cour d'appel de Bruxelles.

The Congress will meet at Brussels on the 27th September next, in the Great Hall of the Belgian Academy of Sciences, Literature, and Art, and the sittings will probably last four or five days.

Members of the Society of Arts desirous of attending the Congress should communicate with the Secretary to the Committee, M. Edouard Romberg, 58, Rue Royale, Brussels.

The following is the programme of questions which it is proposed to bring under the consideration of the Congress:—

I.

Should the principle of international recognition of the proprietary rights of authors and artists in their works form an element in the legislation of all civilized nations?

Should this principle govern the conduct of one nation towards another, even in the absence of reciprocity?

Should the rights of foreign and native authors and artists be absolutely and in every respect similar?

Should foreigners be called upon to pass through special formalities in order to obtain these proprietary rights, or ought it to be sufficient for them to comply with such regulations as are required by the laws of their own country?

Is it desirable that all nations should adopt a system of legislation on this subject, founded upon a uniform basis?

II.

What duration should be assigned to the proprietary rights of authors and artists in their works?

Should any difference be made, under this head, between the various classes of productions, such as literary works, musical compositions, and paintings or designs?

If these rights should extend beyond the life of the author, should any distinction be made in the period of duration according to the various classes of persons who may succeed to this kind of property, such as survivors' children and other heirs, and those to whom the rights may have been transferred by purchase or otherwise?

What should be the duration of proprietary rights in a posthumous work, or one produced anonymously, or under an assumed name?

Are speeches, lectures, &c., which may be taken down in short-hand, capable of being legally recognised as the property of their authors?

Should the proprietary rights in the original text of a work be similarly extended to a translation?

Should not this depend in every case on certain conditions, such as the obligation to publish the translation within a given time?

Should any particular formalities, the neglect of which might deprive an author or artist of his proprietary rights, be required?

III.

Should the right of representing dramatic or musical works be independent of that of publication?

Would it be possible to draw a distinction between these two rights during the period of their enjoyment?

Should the composer's proprietary right in a musical composition be such as to prevent the public performance of the whole or any part of it without his permission, whatever may be the character of the work, or the mode of performing it?

Should the proprietary right in musical productions also include the exclusive privilege of making arrangements of the themes contained in them?

IV.

Should the producer of a drawing, a picture, a piece of sculpture or architecture, or, indeed, of any work of art, have the exclusive right to reproduce it or to authorise

* State the number, which in no case must be less than *two.*

† This declaration must be signed, in every case, by, at least, *two* of the members of the Local Board; and, when more than twenty Candidates are examined at any one sitting, by, at least, *three* such members. It must not in any case, be signed by a member of the Board from whom any of the Candidates have received instruction in the subject of the paper to which it refers.

its reproduction, either on the same or on a different scale, and either by similar or by different means to those employed for producing the original?

What means should be adopted to prevent fraudulent copies and piracy of pictures, statues, &c.

What special measures should be taken to prevent the forgery of the artist's signature to works of art?

Should proprietary rights in works of design also include any applications of them which may be made in manufactures?

Should any special formalities be necessary to secure proprietary rights in works of art which are not produced by any kind of printing or engraving?

V.

Would the Congress be prepared to recommend the adoption of the following provisions as having reference to the object has in view?

(*a*) The abolition of customs duties on books and works of art, or, at least, a reduction of them to the most moderate scale, and the simplification of the tariff in cases where it classifies the objects to be charged.

(*b*) The re-admission, duty free, when returned unsold, of works sent abroad for sale.

(*c*.) The reduction of postal charges on printed matter.

(*d*) The allowing proofs with corrections to pass as printed matter in those countries where this is not now permitted.

SILK FROM VICTORIA.

The following paragraph is taken from the *Australian and New Zealand Gazette*:—

"Hopes, it appears, are entertained of a new branch of export of a rather novel character, for it is stated that a native variety of the silk worm may be found in the bush of this colony, clinging in countless swarms to the shrub which forms its food. The worm is enclosed in a dark-coloured cocoon, the exterior of which is of extraordinary toughness, and encloses a quantity of yellowish silk. The staple of this, both as regards its fineness and length, has been pronounced by a manufacturing house in Glasgow, by whom it was tested, superior to the product of the best European worms. Specimens of the silk were forwarded some time back to the Melbourne Chamber of Commerce, who, while acknowledging the donation, have apparently paid no further attention to the subject. However, as we believe it to be one of considerable importance to the colony, we hope the discovery will receive that consideration which its intrinsic merits deserve. Reliable authorities state that there is no assignable limit to the quantity of cocoons that may be gathered in a favourable locality. A box as large as a small tea-chest was filled with them in about 10 minutes; and it is calculated that two hours devoted to the work of collection would afford enough to yield 2lb. of raw silk. If this opinion be borne out by actual experiment, the employment would prove highly remunerative, for the present price of the material is nearly 15s. per lb. Mr. Whyte has gathered some cocoons, and intends shipping them to some relatives connected with the silk manufacturing trade."

M. Gerard Kreeft, dating from 14, Red Lion-street, Holborn, in a letter referring to this paragraph, says:—

"1. The cocoons containing silk which have come under my observation were generally found deposited under the loose bark of Eucalyptus rostrata, Schl., or Eucalyptus acuminata, Hook, the flooded gum tree of the colonist, and are the productions of a large hairy caterpillar, from two to three inches in length, which feeds on various shrubs, and eventually selects the bark of the flooded gum tree for its transformation into the cocoon.

"I have kept one of these caterpillars in a box, and after it had spun itself in I removed the silk. The next morning the insect had surrounded itself afresh; again I disturbed it, only to find it enclosed in a new shroud 12 hours afterwards. Specimens of the moth are at the Melbourne Museum. This caterpillar or silkworm is distributed over a large tract of country. I have found it along the banks of the Murray from Maidens Punt to the Darling junction, and about 100 miles along the bank of this river.

"Although cocoons are plentiful, I rather doubt that 'two hours devoted to the work of collection' would produce 2lb. of raw silk, and I should consider it a fair day's work to gather from 3lb. to 4lb. of cocoons, as they weigh very light indeed.

"2. There is also a silver-gray spider, with thin round body and long cherry brown legs (not hairy), spinning its meshes among the bushes of the Murray scrub, and the silk produced by this insect far surpasses in strength and glossiness the silk of the caterpillar before mentioned.

"Riding through the scrub my progress was sometimes impeded by the web of this spider, which often covered an area of several square yards, the threads being so strong that they never broke at the first attempt to push through.

"Specimens of this spider are to be found at the Melbourne Museum, as also a quantity of silk presented by Mr. Surveyor Kerr.

"Before I conclude I beg to state that my observations were made when in charge of a collecting party fitted out by the Victorian Government."

SOUTH KENSINGTON MUSEUM.

During the week ending 31st July, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,687; on Monday and Tuesday (free evenings), 3,045. On the three Students' days (admission to the public 6d.), 865; one Students' evening, Wednesday, 109. Total, 7,706.

PARLIAMENTARY REPORTS.

PRINTED SESSIONAL PAPERS.

Parl. No.

Delivered on 26th July, 1858.

233. Bills—Universities (Scotland)—Lords' Amendments.
234. ——— Judgments (Ireland) Act Amendment (amended).
235. ——— International Patent Right.
236. ——— Government of India—Lords' Amendments.
237. ——— Sale and Transfer of Land (Ireland)—Lords' Amendments.
238. ——— Leases and Sales of Settled Estates Act Amendment (1856).
239. ——— Administration of Oaths by Committees.

Delivered on 27th July, 1858.

419 (1). Metropolitan Main Drainage—Plans.
450. Proceedings on Private Bills—Lords' Report.
460. Standing Orders Revision—Report.
240. Bill—Government of India (No. 3) (as amended by the Lords).

Delivered on 28th and 29th July, 1858.

446. County Court Treasurers—Return.
453. Civil List Pensions—Return.
457. Education (Ireland)—Annual Report.
458. 100th Regiment—Return.
467. East India (Charges on Consolidated Fund)—Return.
441. Savings Banks—Report from Committee.
246. County Treasurers—Abstract of Accounts.
468. Foreign Shipping—Account.
469. Dublin Port—Account.
480. Gold (Australia)—Return.
414. Embassy House (Paris)—Copy of Correspondence, &c.
183. Bills—Landlord and Tenant (Ireland).
184. ——— Emblements, &c. (Ireland).

Delivered on 30th July, 1858.

363. Billeting System—Report and Evidence.
407. Public Income and Expenditure—Accounts.
448. Naval Prize Money, &c.—Account.
456. British Museum—Copy of a Memorial.
471. Metropolitan Main Drainage—Return.
472. Spirits—Returns.
241. Bill—Local Government—Lords' Amendments.

Delivered on 31st July and 2nd August, 1858.
340. Lunacy—12th Report of Commissioners.
463. Constabulary (Ireland)—Statement.
465. Income Tax—Return.
429. Stade Tolls—Report.
484. Army—Return of the Number of Men who deserted.
417. Foreign Office Re-construction—Report and Evidence.
242. Bills—Government of India (No. 3)—Lords Reasons.
243. ——— Art Unions Indemnity (as amended by the Lords).
244. ——— Reformatory Schools (Ireland)—Lords Amendments.
245. ——— Metropolis Local Management—Lords Amendments.
246. ——— Divorce and Matrimonial Causes—Lords Reasons.
247. ——— New Writs (as amended by the Lords).

Session (Second), 1857.
77 (C 1). Poor Rates and Pauperism—Return (C 1), In-Maintenance and Out-Door Relief.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July* 30, 1858.]

Dated 24th May, 1858.
1156. J. Edwards, 77, Aldermanbury, and T. Loveridge, 74, Aldermanbury—Imp. in the manufacture of buttons and other fastenings for articles of dress.
Dated 29th June, 1858.
1468. H. Greaves, Westminster—Imp. in apparatus for moulding, casting, and coating metal articles.
Dated 1st July, 1858.
1476. T. Whiteley, Stainland, Halifax—Imp. in the manufacture of millboard, and in machinery or apparatus for cutting millboard and paper.
1478. Lieut. J. Kingsley, 52, Great Coram-street, Middlesex—Improved mechanical arrangements applicable to preventing the sudden bursting of steam boilers.
Dated 2nd July, 1858.
1486. E. Lord, Todmorden, Yorkshire—Imp. in looms for weaving, parts of which are applicable to other machines, and in machinery for making the crank shafts of looms and other machines.
Dated 6th July, 1858.
1514. J. Dodd and T. Phillips, Ruabon, Denbighshire—Imp. in the slide valves of steam engines.
Dated 10th July, 1858.
1553. A. Porecky, 7, York-street North, Hackney-road—Imp. in the manufacture of certain articles of whalebone, horn, tortoiseshell, and other corneous matters, or the artificial imitations thereof.
1555. W. Langshaw, Bolton, Lancashire—Imp. in machinery or apparatus for weaving fancy-looped or knotted fabrics.
1557. P. Burrell, 2, Middle Scotland-yard—Imp. in ventilating sewers and other receptacles of sewage.
Dated 12th July, 1858.
1559. J. Loach, Birmingham—Certain imp. in ornamenting glass with perforated metallic and other plates.
1563. R. A. Brooman, 166, Fleet-street—Certain new or improved machinery for the manufacture of wire heddles. (A com.)
1565. N. Defries, 5, Fitzroy-square—Imp. in apparatus for measuring gas.
1567. T. Earnshaw, Cambridge-terrace, Thornton-heath, Croydon—Imp. in the manufacture of night lights.
Dated 13th July, 1858.
1569. J. Webster, Birmingham—An improved manufacture of certain kinds of metallic ingots.
1571. J. Travis, T. Sugden, and F. Sugden, Oldham—Certain imp. in lubricating the valves and pistons of steam engines.
1573. J. J. Field, Paddington—A new method of supporting and carrying telegraph wires, ropes, and cables.
1575. A. Shanks, 6, Robert-street, Adelphi—Imp. in machinery for planing, slotting, and shaping metals.
1577. R. Wilson, 9, and A. Horwood, 8, Salisbury-mews, Great Quebec-street, Marylebone-road—An improved pipe joint.
Dated 14th July, 1858.
1579. C. de Poorter, Brussels—Imp. in hand or power looms.
1581. R. Burns and J. Rea, Liverpool—Imp. in machinery for grinding bones and other hard substances.
1583. F. Chapusot, Turin, and V. Avril, Paris—Imp. in producing a more or less perfect vacuum, and in applying the same to industrial purposes.
1585. E. Owen, Blackheath—Imp. in distilling.
1587. J. Maclean, Edinburgh—Imp. in machinery or apparatus for laying or submerging telegraph cables in water.
1589. H. W. Wimshurst, Wilmot-road, Dalston—An imp. in stove grates.
1591. J. Fowler, jun., 28, Cornhill—Imp. in apparatus used when ploughing, tilling, or cultivating land by steam power.
Dated 15th July, 1858.
1593. R. Brazier, Wolverhampton—Imp. in repeating fire-arms.
1595. C. P. Aston, Cross-street—Imp. in breech-loading arms.
1597. H. Bevan, Shrewsbury—A new or improved machine for effecting or facilitating arithmetical operations.
1599. T. Bartlett, King's-road, Bedford-row—Imp. in stoves, fireplaces, and furnaces.
1601. W. E. Newton, 66, Chancery-lane—An improved mode of giving alarm in cases of fire in houses, ships, or other buildings. (A com.)
Dated 16th July, 1858.
1603. T. Leigh, Manchester—Imp. in machinery or apparatus for sizing warps.
1605. C. de Bergue, 9, Dowgate-hill—Imp. in electric telegraph cables for submarine purposes, and in the machinery for manufacturing such cables, and also in the machinery to be used in paying such cables out of ships at sea.
1607. P. Arkell, North Woolwich, and A. Melhado, Queen's-gardens, Bayswater—Imp. in the submerging of telegraph cables.
1609. C. S. Putnam, New York—An imp. or imps. in the apparatus for hardening vegetable gums, oils, and other substances susceptible of being hardened by steam.
1611. W. A. B. Bennett, 13, Rue Tant perd tant prie, Boulogne—Imp. in military capes or cloaks.
Dated 17th July, 1858.
1613. J. Spence, Liverpool—An imp. in the manufacture of tin plates and terne or leaded plates.
1615. W. Wildes, Maidstone—An improved arrangement or arrangements of machinery for reducing vegetable matter to pulp.
1617. W. Pidding, Southwark Bridge-road, Southwark—Imp. in securing and forming envelopes.

Inventions with Complete Specifications Filed.
1667. M. Shanty, 5, Meard's-street, Dean-street, Soho square—A mercurial level, to show the height of liquids in enclosed and opaque vessels, vases, and principally for steam boilers. (A com.)—24th July, 1858.
1669. M. Shanty, 5, Meard's-street, Dean-street, Soho-square—A metallic trimming for intercepting water, air, gas, or steam round piston rods, of whatsoever they may be, the same may be applied to the joints of steam machines. (A com.)—24th July, 1858.

WEEKLY LIST OF PATENTS SEALED.

July 30th.
127. J. Gordon.
179. J. A. Manning.
182. W. E. Newton.
187. W. C. Holmes and W. Hollinshead.
188. W. E. Newton.
August 2nd.
195. A. Hollis and S. Lee.
214. E. and T. Collingwood.
217. Sir C. Shaw.
218. S. Williamson.
219. S. Dyer.
220. L. F. Candelot.
222. W. Potts.
223. G. Davies.
224. W. White and J. Parlby.
225. W. Ball.
226. J. Miller.
228. F. Mathieu.
229. J. D. Tripe.
230. P. S. Meroux.
232. E. Dench.
233. R. W. Johnson and W. Stableford.
234. W. E. Newton.
235. H. Ball.
240. R. Millard.
242. E. Leigh.
244. B. B. Wells.
247. G. and W. Richardson.
258. B. Looker, jun.
269. T. Neville & W. S. Dorsett.
279. W. Spence.
289. H. J. Sanders & S. Thacker.
290. W. E. Newton.
319. R. Griffiths.
380. A. V. Newton.
393. M. Henry.
405. W. E. Newton.
463. E. Morel.
466. B. B. Stoney.
468. J. H. Johnson.
567. W. H. Rhodes.
663. J. Baillie.
902. J. O. York.
1030. T. and D. Brown.
1083. J. Gardner.
1134. G. F. Muntz.
1174. F. A. Gatty.
1194. G. H. Bovill.
1239. C. Wheatstone.
1241. C. Wheatstone.
1255. J. Baron von Liebig.
1297. F. A. Gatty.
1326. L. A. Bigelow.

Patents on which the Stamp Duty of £50 has been Paid.

July 26th.
1707. C. Hodges.
1762. R. A. Tilghman.
1969. J. Hope and T. Hope.
July 27th.
1722. J. Kerr.
1777. J. Avery.
July 28th.
1727. J. M. Fillier.
1732. J. Hanson.
1734. H. Mackworth.
July 31st.
1747. A. Allan.
1748. J. Stanley.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4107	July 17.	Penholder	M. Schelham	Birmingham.
4108	„ 22.	Apparatus for containing and supplying Blacking and other fluids	C. H. Hall	Grosvenor-street, London.
4109	August 2.	A Ship Ventilator	Bathgate and Wilson	Canning Foundry, Liverpool.
4110	„ 4.	Boiler Flue	B. Goodfellow	Hyde, Chester.

Journal of the Society of Arts.

FRIDAY, AUGUST 13, 1858.

SOCIETY OF ARTS EXAMINATIONS.

The Council have much pleasure in announcing that Mr. Thomas Ross Howard, of the Crosby Hall Evening Classes, and Mr. George Edward Skinner, of the Lymington Literary Institution, who distinguished themselves at the Society's Examinations in May last, and who had been nominated by the Council to compete for Clerkships in the Customs, have been successful in obtaining appointments. There were on this occasion four vacancies and twelve competitors, and two nominations were placed at the disposal of the Council by Lord Derby.

The following letter has been received from the Secretary to the Treasury, communicating the result of the competition:—

Treasury, S.W., 11th August, 1858.

Sir,—I have much pleasure in informing you that Mr. Thomas R. Howard and Mr. George E. Skinner have succeeded in obtaining the first and third places, respectively, in the late competition for four clerkships in the Customs; and I have written to request their attendance at this office on Friday next, when the successful candidates will decide which of the appointments they prefer to select.

I should mention that Mr. Howard is reported by the Civil Service Commissioners to have shown "marked proficiency" in all the prescribed subjects of examination.

I have the honour to be, Sir,
Your obedient servant,
WM. G. HYLTON JOLLIFFE.

P. Le Neve Foster, Esq.

NOTICE TO INSTITUTIONS.

In accordance with the resolution passed at the last Annual General Meeting of the Society, the Council will present to each Institution in Union a quarto copy of the Speeches and Addresses of H.R.H. the Prince Consort.

The Department of Science and Art have placed in the hands of the Council a number of copies of the "Introductory Addresses on the Science and Art Department and the South Kensington Museum," delivered there during the last session, and a copy of this work will also be presented to every Institution in Union.

In addition to the above, the Council have decided to present to each Institution copies of twenty-two lectures delivered before the Society of Arts, on the results of the Great Exhibition of 1851.

Institutions desiring copies of these works are requested either to apply for them at the Society's House, or to communicate to the Secretary of the Society of Arts the address of an agent in London to whom they may be sent.

EXEMPTION FROM LOCAL RATES.

It will be remembered that in June last, as mentioned in the Secretary's Report read to the Conference,* a Select Committee of the House of Commons was appointed to inquire into the operation of the law as it at present stands, by which land occupied by public establishments is rendered exempt from local rates and taxes. The Committee consisted of the following gentlemen:— Sir Francis Baring, Mr. Edward Pleydell Bouverie, The O'Donoghoe, Sir James Elphinstone, Mr. Sotheron Estcourt, Mr. Hardy, Mr. Horsfall, Mr. Howard, Sir Cornewall Lewis, Mr. John Locke, Mr. Ker Seymer, Sir Frederick Smith, Mr. Wilson, Sir Charles Wood, and Mr. Eliot Yorke. As this is a question of considerable importance to the Institutions in Union, it has been thought desirable to publish the following report of this Committee:—

Your Committee commenced their inquiry "into the operation of the law as it at present stands, by which land occupied by public establishments is rendered exempt from local rates and taxes," by examining Mr. Lumley, the Assistant-Secretary to the Poor-law Board, on the state of the law respecting exemptions from rates. They next proceeded to examine witnesses locally connected with the towns of Portsmouth and Chatham; with the Greenwich Union, which includes the towns of Deptford, Greenwich, and Woolwich; with the towns of Devonport and Plymouth, and the adjoining parish of Anthony; with the parishes of Alverstoke and Rowner, on the coast of Hampshire; with the parish of Sandhurst, in the county of Berks; with the parish of St. George's, Southwark; and with the parish of St. Mary-le-Strand, Westminster. They likewise took the evidence of a member of the Town Council of Liverpool, with respect to the classes of property exempt from rates, on different grounds, in that borough.

Your Committee refer to this evidence as exhibiting the nature of the exemptions from local rates, their practical operation in the parishes where they prevail to the largest extent, the complaints to which they give rise among the ratepayers representing the unexempted property, and the remedies proposed for the removal of the additional burden which the exemptions create.

Your Committee now proceed to state the principal results of the evidence which they have received, together with the conclusions to which they have arrived upon the subject referred to their inquiry.

In order to render property rateable to the poor, under the Act of 49 Elizabeth, it is necessary that there should be an occupier, and that his occupation should be of such a nature as the law considers beneficial. The same principle applies to most of the other local rates. By "beneficial occupation," for the purposes of the law of rating, is meant an occupation from which the occupier derives either a pecuniary profit or some personal advantage or convenience.

The exemptions from the liability to local rates which arise under the existing law may be divided into two classes: 1. Exemptions created by statute, in cases where there is a beneficial occupation; 2. Exemptions on account of the non-existence of a beneficial occupation.

The most important exemptions belonging to the first class are those established by the 3 and 4 Will. 4, c. 30, which exempts all churches, chapels, and other places of religious worship from poor-rates and church-rates; and by the 6 and 7 Vict. c. 36, which exempts lands and

* See present Vol., p. 492.

buildings occupied by scientific or literary societies, from county, borough, parochial and other local rates. There are likewise statutory exemptions for turnpike tolls and tollhouses, and for certain lighthouses.

The second class of exemptions, which are much more extensive in their operation than the former class, arise from the application of the legal rule, requiring, as a condition of rateability, that there should be an occupier having a beneficial occupation. As a beneficial occupation is understood to be an occupation from which some peculiar, separate, and private profit or advantage accrues or may accrue to the occupier, it follows that where lands or buildings are occupied for a public purpose, they are exempt from rate. All lands or buildings belonging to the Crown, and occupied for a national purpose, such as forts, fortifications, dockyards, arsenals, barracks, naval and military storehouses and hospitals, guard-houses, workshops, and factories for artisans employed in naval and military works, military colleges, artillery and parade grounds, government prisons, buildings used for the business of public departments, as the Treasury or the Admiralty, as well as Custom-houses, Post-offices, &c., are for this reason exempt from local rates. Official residences, likewise, where they are necessary for the discharge of the duties of the public officer, are for the same reason held to be exempt. But where property belonging to the Crown is in the possession of an occupier having a beneficial occupation, the exemption does not apply; hence the tenants of Crown lands are rateable like tenants of lands belonging to private owners; the rangers of the Royal parks are rateable for their residences; and it has even been held that the inmates of Hampton Court Palace are subject to the rate, notwithstanding the precarious nature of their tenure. For a similar reason, buildings and lands occupied by municipal or other public bodies for a public purpose, such as county and borough gaols, judge's lodgings, court-houses, police stations, are within the exemption. Public roads and bridges are likewise exempt, though canals, railways, and other means of communication yielding a return to a company of proprietors, for their own advantage, are rateable.

The County Lunatic Asylum Acts render a county lunatic asylum rateable, according to the value of the land, as it was at the time of the purchase or acquisition. A similar rule applies to Burial grounds under burial Boards. With regard to workhouses belonging to a union under the Poor Law Amendment Act, it has been decided by the Court of Queen's Bench, in the case of The Queen *v.* Wallingford Union, that they are not within the exemption applicable to buildings occupied for a public purpose.

It may be remarked that in some of the cases of buildings and lands used for a public purpose, such as parish highways or barracks, it is difficult even to determine who is the occupier, independently of the question of beneficial occupation.

The rule respecting the exemption of property occupied for a public purpose has been held to extend to charitable institutions maintained by a private endowment, such as hospitals, free schools, and other similar establishments. In these cases, neither the trustees who receive and apply the endowment, nor the objects of the charity who profit by its application, are considered as having such a beneficial occupation as renders them liable to be rated. It is not easy to understand the grounds upon which charitable institutions maintained by a private endowment have been brought within the benefit of the rule which applies to institutions maintained out of public funds for a public purpose.

A third but limited head of exemption, not included it either of the above classes, is that which arises from the prerogative and the political status of the Sovereign. All lands and buildings in the personal occupation of the Sovereign are exempt from local rates; hence, not only the Royal palaces personally occupied by Her Majesty, but the Royal parks and pleasure grounds, enjoy an immunity from local taxation.

As parochial rates are assessed upon a limited district, any exemption which withdraws a portion of property from the rateable fund operates as a sensible detriment to the other ratepayers, because it increases the common burden, whatever may be the amount of the expenditure. In parishes where a single post-office, or hospital, or scientific institute is withdrawn from the entire assessment, the exemption may not be of much practical importance; but where, as in the seats of the great naval and military establishments of the government, large portions of a parish are abstracted from the common rateable fund, the consequences to the ratepayers are serious. Thus the poor-rate assessment of the parish of Portsmouth is £24,183, and the annual amount levied as poor-rate and borough-rate is 6s. in the pound;* but the exempted property in the parish, occupied by the government for national purposes, is estimated at an annual value of £8,000. This sum is equal to one-third of the existing assessment; and, if it were added to that assessment, the poundage rate required to produce an equal sum would be one quarter less; that is to say, instead of a rate of 6s., a rate of 4s. 6d. in the pound would be levied. The assessment of the parish of Portsea is £151,179, and the same rates are 4s. 8d. in the pound. Since 1845, property assessed at £1,077 has been thrown into the dockyard, or otherwise rendered exempt; one-seventh of the parish is stated to be occupied by the government, and not to be assessed to the poor-rate.

Examples of the same state of things occur in other towns where large government establishments exist. Thus, in the parish of Chatham, the assessment is £37,063, upon which the county and poor-rates are now 4s. 10d. in the pound; more than 100 acres, containing barracks, hospitals, a fort, a gun wharf, and a dockyard, are occupied by the government, and withdrawn from the parochial rates. In the parish of Greenwich the assessment is about £130,000; and the county and poor-rates are 4s. 4d. in the pound. It contains the large public establishment of Greenwich Hospital, which is exempt from rates. Greenwich Park is likewise exempt, as being in the occupation of the Crown. In the parish of Woolwich the assessment is about £60,000 upon a low valuation, and the rates are now about 4s. 8d. in the pound. In this parish about two-thirds of the frontage, on the south bank of the river, is occupied by the government for a dockyard and arsenal, and the land and buildings thus employed contribute nothing to the local taxation. The town of Deptford lies in two parishes, St. Nicholas and St. Paul's, which were formerly one parish, and were separated by a Local Act. In St. Nicholas the assessment is about £13,000, upon a low valuation; the county and poor-rates are now 10s. in the pound; besides which there are rates for sewerage, paving, and lighting, to the amount of 2s. in the pound; making altogether 12s. in the pound. The assessment of St. Paul's is about £100,000; and the county and poor-rates amount to about 3s. 6d. in the pound. The parish of St. Nicholas comprises between 70 and 80 acres of land, of which about two-fifths are occupied by government establishments, as slips for shipbuilding, storehouses, dry and wet docks, and official residences. St. Paul's includes the victualling yard and a small portion of the dockyard.

Similar effects are produced by the large government establishments at Devonport. The assessment of the parish of Stoke Damerel or Devonport is £62,919, and the average annual rate for the last five years is 7s. 1½d. in the pound. This amount includes all the rates levied in the parish. In the neighbouring parish of East Stonehouse the assessment is £23,037, and the rates are 4s. 10d. in the pound. In the two parishes of Plymouth the assessment is £112,465, and the rates are about 6s. 7d.

* The statements of assessments and poundage rate in this report refer to periods of a year.

in the pound. In these four parishes the land occupied by the government, and therefore withdrawn from the rate, stands in the following proportions to the rest of the parish:—

In Devonport 244 out of 1,815 acres.
In East Stonehouse, 50 out of 176 acres.
In Plymouth, 25 out of 1,635 acres.

The government property in Devonport is occupied partly for the dockyard, steam-yards, powder works, and other manufacturing purposes, and partly for barracks, officers' residences, and fortifications. The parish of Stonehouse contains the Marine Barracks, the Victualling Office, and the Naval Hospital.

In the parish of Antony, near Devonport, the War Department have recently purchased land, assessed at £621; the total assessment of the parish being £7,640. The land thus purchased, being devoted to a public purpose, will be subtracted from the rateable property of the parish. The rates in this parish are now about 3s. 5d. in the pound.

The operation of the same principle is further illustrated by the parish of Alverstoke, and by the neighbouring parish of Rowner, on the coast of Hampshire. The assessment of the parish of Alverstoke, including the town of Gosport, is upwards of £29,000, upon which the average annual rate for the last five years is 4s. 6d. in the pound for the poor and county, besides a paving rate in Gosport of 2s. 6d., and a highway rate in the rural part of the parish of 4d. to 6d. in the pound. The total area of Alverstoke parish amounts to 4,077 acres; of which space 1,625 acres, being two-fifths of the whole, are occupied by the Admiralty and War Department as a Naval Hospital, a Victualling establishment, a magazine for powder and shot, fortifications, gunboat slips and barracks. In the parish of Rowner, the War Department have recently purchased 395 out of 1,195 acres for the erection of fortifications. The assessment of the entire parish is £1,340; the land subtracted from the rateable fund by the government is assessed at £462, being more than a third part; the present rates are only 1s. in the pound.

In the parish of Sandhurst, in Berkshire, which contains 4,014 acres, an area of 425 acres is occupied by the Military College. The assessment of the entire parish is £2,018; the county and poor-rates are about 2s. 6d. in the pound up to the present time; the land and buildings occupied by the College have been included in the assessment, and have contributed to the parish rates; but notice has been given to the parish officers that the exemption will henceforth be claimed; and as the assessment of the land occupied by the College amounts to one-sixth of the whole, the burdens of the other ratepayers will be increased by one-sixth. The same parish likewise contains two other institutions exempt from rating, namely, Wellington College, and a Government lunatic asylum.

Another class of exemptions is exemplified by the parish of St. George's, Southwark. The assessment of this parish is £120,500, upon which the rates now amount to 6s. 11d. in the pound. It contains several institutions which are exempt under the general law, namely, Bethlem Hospital, the House of Occupation, the Blind Schools, the Deaf and Dumb Schools, the Magdalen, the Yorkshire Schools, and the Post Office. The annual rateable value of the exempted property in this parish is estimated by Mr. John Day, the assistant-overseer, at £20,000. This sum is equal to one-sixth of the existing assessment.

The parish of Liverpool furnishes instances of exemptions belonging to various classes. The valuation of the parish is £1,377,170, and the rates are about 4s. in the pound. The property exempt from rate consists of three classes. First, the corporation property, consisting of the markets, weighing machines, public baths and wash-houses, the free lending library, the observatory, the town hall, with the various public offices, the exhibition rooms for the academy of art, the public health offices, the office for weights and measures, the house occupied as the judge's lodgings, St. George's Hall, with its appurtenances, the waterworks for the purpose of supplying the town with water, and various yards, sheds, counting-houses, and workshops, for the purposes of artificers connected with the estate. Secondly, buildings occupied by the government, namely, the Custom House, the Excise Office, the Post Office, the barracks, and the recruiting establishment. Thirdly, the property occupied by the Mersey Dock and Harbour Board. The aggregate rateable value of these three classes of property, now exempt from the rate, was stated to your Committee, by Mr. Picton, a member of the Town Council of Liverpool, and an architect and surveyor, to amount to £183,539 in the parish of Liverpool, and £36,280 in the parish of Toxteth-park, both being within the borough of Liverpool. If the whole of this property were brought into the rate at Mr. Picton's assessment, it would diminish the burdens of the present ratepayers of the parish of Liverpool by about one-sixth, or 8d. in the pound, except so far as the additional borough rate, which would be increased by a corresponding amount, should fall upon the same ratepayers.

Some of the public buildings and institutions entitled to exemption are detrimental to the ratepayers only by diminishing the rateable fund of the parish. Such, for example, are offices belonging to public departments, town-halls, court-houses, hospitals, museums, and fortifications. Some government establishments, however, not only operate as detractions from the rateable property, but by their indirect effects add to the burden of pauperism, or further diminish the productiveness of the rates. Thus, in the Portsmouth Union, the charge on account of the wives and children of soldiers, sailors, and marines, and of sailors and soldiers, whom the government establishments bring to this spot, was £2,446, out of £23,461 expended in the relief of the poor during the last year. One-fourth of the pauperism of Chatham parish is estimated to arise from the widows and children of soldiers, and of government artisans and labourers, who are drawn to it by the public establishments. In this parish likewise a sum of nearly £1,200 a year is excused to occupiers of small tenements, of whom about two-thirds are married soldiers, marines, and sailors, or labourers in Her Majesty's yard. Mr. Saw, clerk of the Greenwich Union, on a recent inspection of the union workouse, ascertained that out of 455 adult female inmates, 199, or 44 per cent., had been connected with the government establishments: he thinks that this ratio would apply to the out-door poor in the parish in Woolwich, but would be too high for the other parishes of the Greenwich Union. Mr. Ryder, Vice-chairman of the Commissioners of Devonport, thinks that, at the lowest estimate, three-tenths of its pauperism is due to the government establishments in the parish, and to the maintenance of wives and widows of sailors: he states that nearly one-half of the widows and children receiving relief are the widows and children of persons directly connected with the dockyard.

A similar effect is produced in Alverstoke. In this parish the amount paid in out-door relief for the maintenance of the wives and families of sailors and marines amounts, upon the average of the last four years to £151 per annum, being one-tenth of the whole of the out-door relief paid in the parish. Other expenses are likewise produced by the persons discharged from Haslar Hospital. The cost of the legal relief of the poor in this parish has increased from £4,125 for the parochial year 1854, to £6,326 for the parochial year 1858. The Rev. Mr. Walpole, incumbent of the parish, states that, during the last five or six years, the rather large sums distributed as alms by him, or under his direction, have to the extent of three-fourths of their amount, been given to persons who had been brought into the parish by

public works, and had become ill, or to their wives and families whom they had deserted. In the neighbouring parish of Rowner the cost of the relief of the poor has hitherto been trifling; but it is anticipated by a local witness that the purchase by the War Department of 395 out of 1,195 acres may derange the balance of labour and population, and reduce a portion of the labouring families to pauperism. It is feared likewise that a similar purchase in the parish of Antony, near Devonport, will increase the charges upon the poor-rate.

It might be supposed that the seaports and other places containing large Government establishments for military and naval purposes would be compensated by the Government expenditure, and the stimulus which it gives to labour and retail trade, for the diminution of the local taxation, and the increase of the charge for the relief of the poor. There is no doubt that when such establishments have once been created, and the habits of the population have been adapted to their existence, their sudden suppression would be productive of serious local inconvenience, and would be regarded as an evil by the inhabitants. But the evidence received by your Committee proves that the places where those establishments exist would probably have enjoyed greater prosperity if they had never been created, and would have derived more advantage from the development of their commercial resources than they have derived from the local Government expenditure. Fortifications, dockyards, and other naval and military establishments are inconsistent with the enterprise of private trade, and the Government steadily interferes to prevent the construction of any works in the neighbourhood. Thus, at Portsmouth, improvements of the town and a new line of railhave been stopped by the Government on this account. Mr. Stigant, who has been three times mayor of Portsmouth, says: "We have made several attempts to obtain mercantile docks in the neighbourhood, and proposed several localities to the Government authorities for their consent, but we have been universally refused, they saying that they can never consent to docks or any matter of that sort being within the borough of Portsmouth, consequently we are excluded from speculation or improvement in mercantile affairs. We are obliged to depend wholly and solely upon the Government establishments for our position. There is a very strong feeling among a large number of the inhabitants that the harbour of Portsmouth would be very quickly rendered a mercantile harbour of the first character in the kingdom if we could only have access to it." "When I was mayor (he adds), the town council was applied to by steam companies for accommodation in Portsmouth, and we were obliged to refuse it."

Mr. Woollcombe, who has been town clerk of Devonport for nearly twenty years, states "that since his knowledge of the place, there has never been a single attempt to carry out anything which required facilities as regards water communication, which has not been objected to." "I do not mean to say (he adds), improperly objected to, but which has not been objected to by the Admiralty, on the ground that it was an interference with the Government water, which could not be sanctioned." The same witness further expresses an opinion that if there had been no Government interferences at Devonport, the large docks in connexion with the Great Western Railway which have recently been established in Mill Bay, in Plymouth, would have been established in the dockyard of Devonport and the Keyham Steam Yard. He states, moreover, that the Post-office packets for the Cape of Good Hope were recently removed from Devonport to Mill Bay in consequence of objections made by the Admiralty.

An application, some years ago, was made to the Admiralty for permission to construct commercial docks at Haslar Lake, near Gosport, in the parish of Alverstoke. The superintendent of the dockyard reported in favour of the plan, but the application was refused; the space is now occupied by the gun-boat slips; and having formerly been liable to pay parish and county rates, is now exempt from that liability. The Rev. Mr. Walpole, the incumbent of Alverstoke, expresses a strong opinion as to the economical evils brought upon his parish by the Government establishments; he believes that not only has its commercial development been prevented, but also the formation of a watering-place upon the coast been rendered impossible by the Government occupation.

It has been represented by the witnesses, that owing to the existence of Government establishments, and the character of the population which they attract, the value of property is in some cases diminished. It is stated that rents in Chatham, particularly rents of houses, are lower than in any town in Kent; and that in Devonport the value of houses has for a series of years been diminishing, while in Plymouth, where there are no Government establishments, it has been increasing. At the beginning of the century the population of Devonport was 23,747, and the number of its houses 2,352, at the same time the population of Plymouth was 16,040, and the number of its houses 1,782. According to the census of 1851, those numbers stood as follows:—

	Population.	Houses.
Devonport	37,338	4,027
Plymouth	51,281	5,595

So that in the last 50 years Plymouth has more than trebled its population and the number of its houses; whereas Devonport has not doubled either its population or the number of its houses. The comparative progress of these towns is attributed by Mr. Woollcombe to the influence of the Government establishments in the one from which the other has been free.

The remedy for the evils experienced in the places where extensive exemptions prevail, which has been proposed by the witnesses to your Committee, is that the exemptions, particularly that relating to property occupied for national purposes, should be abolished, and that property of this class should be assessed and rated like other property.

Your Committee think it right to add, that the Court of Queen's Bench has, of late years, while it gave effect to the existing law, expressed an opinion that exemptions which withdraw a part of the property of the parish from the rate, and thereby increase the proportionate burdens of the other ratepayers, are inequitable.*

In recognizing the reasonableness of the demand for an alteration of the existing law of rating, with respect to exemptions, your Committee would, in the first place, remark that the personal immunity of the Sovereign rests on constitutional grounds, which are not limited to the law of rating, and which have never been brought in question. The property of the Crown, when in the beneficial occupation of a subject, is at present rateable.

Your Committee think it desirable that the exemption for religious buildings, conferred by the Act of 3 & 4 Will. 4, c. 30, and that for burial grounds under burial boards should be maintained. They are likewise of opinion that the exemptions now enjoyed by turnpike tolls and tollhouses, as well as by parish highways, and by county and other public bridges, should continue.

With these reservations they recommend that all land and buildings used and occupied for public, charitable, scholastic, or scientific purposes, whether there be a beneficial occupation or not, according to the received meaning of that term, should be assessed to the local rates, and should pay rates accordingly.

The practical difficulties which stand in the way of this important alteration in the law of rating, are limited

* See Queen v. Sterry, 12 Adolphus and Ellis, 84. Scott v. St. Martin-in-the-Fields, 5 Ellis and Blackburn, 558. Smith v. Birmingham, 7 Ellis and Blackburn, 488.

to the cases of property where there is not, according to legal construction, a beneficial occupation. In some of these cases there is no fund of any private character from which the rate can be paid, as buildings occupied by the Crown, and by counties and boroughs for a public purpose; and, in some cases, there is no personalty upon the land in the possession of an occupier, which could be seized as a distress if default were made in payment of the rate; as fortifications, or docks, or quays belonging to a public department. Again, in many of the cases where there is no beneficial occupation, it would be scarcely possible to fix the assessment of the property according to the principles of the existing law. The parochial assessment Act (6 & 7 Will. 4, c. 96,) provides that "no rate for the relief of the poor in England and Wales shall be allowed by any justices, or be of any force, which shall not be made upon an estimate of the net annual value of the several hereditaments rated thereunto; that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenant's rates and taxes, and tithe commutation rent-charge, if any, and deducting therefrom the probable annual cost of the repairs, insurance, and other expenses, if any, necessary to maintain them in a state to command such rent." (s. 1.) With regard to many buildings used for a public purpose, it would be impossible to estimate the probable net annual rent, with a deduction for tenants' rates and taxes, and other outgoings, such as the existing law contemplates. The net annual rent of buildings, such as the Houses of Parliament, the London Custom-house, the General Post-office, Greenwich Hospital, or the British Museum, as well as of fortifications, barracks, military magazines, docks for the royal navy, courthouses, gaols, and other establishments which could only be used for special public purposes, could not be determined according to the ordinary principles which govern the valuation of rateable property. It is to be noted that the law of rating requires that a building should be assessed according to its value to let in its existing state, and according to its existing destination and capabilities.

Your Committee, however, think it right to point out that the latter difficulty has been, to a limited extent, practically overcome in certain cases, which have been stated to them in evidence. In the parish of Portsmouth, a paving rate is levied under a Local Act passed in 1847, which re-enacted former Acts; and by this Act, property occupied by the government for public purposes, including barracks and magazines is assessed and rated to the paving rate. The assessment of this class of property now amounts to £6,000, upon which an annual rate of about 1s. 6d. is levied. This assessment has remained in force for many years, and is stated to be very moderate. Other Local Acts render the government liable to pay local rates in respect of land purchased for fortifications and other public purposes in the parishes of Portsmouth and Portsea; but the rates do not appear to have been ever collected by the parish authorities under those Acts. Certain buildings occupied for charitable and public purposes, exempt under the general law, are likewise assessed and rated under a Local Act in the parish of St. George's, Southwark. Some of the government offices in Somerset House have also been assessed and have paid rates, as a bounty, to the parish of St. Mary-le-Strand. The assessment for these offices now amounts to £1,789, and the rate has been paid up to the present time; but notice has been given to the parish officers that for the future this payment will be discontinued. The assessment of this parish is £12,000, and the rates are between 5s. and 6s. in the pound.

Your Committee do not see how the principles by which the assessment of rateable property is at present determined can be applied to property of which there is no beneficial occupation, and which has no assignable value to let, supposing it to be brought into the market. It is true that union workhouses are rateable under the existing law, and that an assessment is fixed for them, in which the several parishes of the union acquiesce, although the building must in general be of such a character that it cannot be said to have any assignable value to let. Your Committee, however, doubt whether similar questions between a parish on the one hand, and the Government on the other, would be determined in an equally satisfactory manner. They therefore recommend that, instead of the assessment being fixed by the parish officers, subject to an appeal to petty and quarter sessions, and ultimately to the Court of Queen's Bench, each party, in the event of a disagreement, should appoint an arbitrator, and that the arbitrators should appoint an umpire, who should decide in case the arbitrators should differ, and whose decision should be final.

It would be necessary that the law should fix a liability for payment upon some definite parties, such as the Commissioners of the Admiralty, the Secretary of State for the War Department, the Commissioners of Customs and Inland Revenue, the Postmaster-general, the county justices, the town council of a borough. In the case of public departments, provision would have to be made by a vote of Parliament; in the case of counties and boroughs the parochial rate would be paid from the county and borough rates. (See 4 & 5 Vict. c. 48.)

The liability should be rendered effectual by proper remedies; the remedy afforded by the present law, namely, distress and sale of the defaulter's goods, and imprisonment in default of sufficient distress, is not applicable to the case of persons in public situations, paying money out of a public fund.

It will be observed that unless the alleviation of the parish ratepayers should produce any laxity in the administration of the rates, the abolition of exemptions would lead to no increase of expenditure, and would only effect a change in the distribution of existing burdens. It would diffuse over a wider area a charge now concentrated upon a small district.

The case of the Dock Trust of Liverpool appears to your Committee to depend exclusively upon the peculiar provisions of the Private Act, by which the appropriation of the revenues of that trust is governed, and upon the construction of those provisions by the Court of Queen's Bench. It is wholly independent of the general law, under which the property, now exempt, would be rateable. If any injustice be created by the operation of the existing Private Act, it ought, in the opinion of your Committee, to be rectified by similar legislation. Your Committee will only remark that the general objections to the exemption of property, already adverted to, extend to the case of the Liverpool Docks; while the present law of rating can be applied to it without difficulty, there being a beneficial occupation, and a large revenue from which the rates could be paid.

Your Committee think it right to add, that many other exemptions from rates are created by Local Acts, into which they have made no inquiry, and which they have not taken into their consideration in making the preceding recommendations.

From the evidence brought before your Committee, it appears that some of the departments of the Government have recently taken steps for insisting on the exemption of property occupied by the Government, in cases where the parish rates had been previously paid by the department.* As this extension of the exemption of Government property is contrary to the views expressed by your Committee, and occasions local irritation, they suggest that the Government should consider the expediency of suspending their proceedings until Parliament may have before them the Evidence and Report of your Committee, and may have come to some decision on the question.

* Buchanan, 331. Woollcombe, 593—600. Field, 883—8.

ATLANTIC TELEGRAPH.

Her Majesty's ship *Agamemnon* arrived at Valentia on Thursday morning, the 5th August, with the end of the telegraphic cable, the communication between Ireland and Newfoundland being complete. From the time the *Agamemnon* left Queenstown, on the 18th of July, until she joined the rest of the squadron at the rendezvous in mid-ocean, on the 29th, she experienced a continued succession of heavy winds. The splice was successfully made on the afternoon of the 29th of July, and the ships started towards their several stations. On the evening of the same day, a breach of continuity occurred in the current, which lasted one hour and a-half. The ship was stopped, and the machinery repaired, though not till hopes of holding on the cable had been abandoned. During Friday, it blew a head gale of wind, against which the ship, under her full steam, could hardly make way, even with yards and top-masts struck. On Saturday, the 31st, the wind shifted round to the south-west, and during that day, Sunday, Monday, and Tuesday, it continued to blow hard, with frequent violent squalls, the sea running tremendously high the whole time, and no one expected the cable to hold on from one minute to the other. On Wednesday, the weather moderated, but the swell was still high. About 4 a.m. the change from the lower to the upper coil was successfully made, and during the afternoon shallow water was gained. The second change from the upper to the orlop deck coil was made about 9 o'clock in the evening. At 10 o'clock at night, shoal water of 250 fathoms was reached, after which all went well until the ship anchored in Dowlas Bay, at 6 o'clock on Thursday morning. Soon after the ship's arrival, a signal was received from the *Niagara* that she was preparing to land, having paid out 1,030 nautical miles of cable, while the *Agamemnon* had accomplished her portion of the distance with an expenditure of 1,020 miles, making a total of 2,050 miles. At 3 o'clock in the afternoon the end of the cable was brought on shore, placed in the trench dug for its reception, and put in connection with the galvanometer. Some delay necessarily occurred in setting up the telegraphic instruments taken out by the *Niagara* to Newfoundland. On Monday night, the 9th instant, at 11.15, Newfoundland commenced the use and adjustment of the instruments, and words were telegraphed for the first time. The speed at which the letters came is said to be faster than when the experiments were made at Keyham, previous to laying the cable.

OVERHOUSE TELEGRAPHS.

In a communication printed in the *Journal*, p. 85 of the present volume, Mr. Sydney H. Waterlow called attention to this subject, pointing out the importance of ready telegraphic communication between the numerous police and fire establishments in the metropolis, and advocating the adoption of a system of telegraphic wires for this purpose carried over the tops of the houses. At the date of that communication—December, 1857—Mr. Waterlow had already formed a telegraphic connection between the business premises of the firm to which he belongs, situated in Birchin-lane and London-wall, and the firm have extended the system to their establishment in Parliament-street, so that their three places of business are now in direct speaking communication with each other. It is unnecessary to point out the advantages the system affords in a commercial aspect. Time and labour are necessarily to a great extent economised, and the question then arises, at what cost is this accomplished? Mr. Waterlow, at the request of the Secretary, has furnished the Society with information as to details of construction and cost, from which this statement is drawn up.

The line of wires (double) commences at London-wall, proceeding direct to Birchin-lane, and thence, supported at different intervals, terminates in Parliament-street. The distances and intervals of support are as follows:—

	Feet.
1. From London-wall to Birchin-lane	1,500
2. Birchin-lane to Sterry's, in Cannon-street	900
3. Sterry's to Calvert's Brewery, Upper Thames-street	900
4. Calvert's to Red Lion Wharf, Upper Thames-street	900
5. Red Lion Wharf to Maidstone Wharf, Queenhithe	840
6. Maidstone Wharf to Trigg Wharf, Upper Thames-street	1,050
7. Trigg Wharf to Ponsford's City Mills	960
8. City Mills, crossing the river, to Glass Warehouse (Surrey side)	1,380
9. Glass Warehouse to White's Iron Wharf	750
10. White's to Burr's Shot Tower	1,200
11. Shot Tower to Goding's Brewery	1,200
12. Brewery to Maudslay's	1,569
13. Maudslay's, crossing the river, to Parliament-street	1,535

The wires are supported on poles fixed to the tops of the houses at such convenient distances as are most readily obtainable, and Mr. Waterlow has, for this purpose, used a kind of saddle, in cast iron, carrying a socket into which the supporting pole is fixed. The saddle fits on the ridge of the house and is held in its place by two screws into the ridge tree and four into the rafters. The pole is kept steady and firm by means of guy wires from its extremity to the roof. No injury whatever is done to the house by the fixing of the supports. Six screws only are used, and when removed, all that has to be done is to fill up and make good the holes from whence they are withdrawn. The Telegraph wires are No. 14 guage and are of steel, but little larger than common bell wire, thus combining strength with lightness. It might have been imagined that difficulty would occur in obtaining the assent of the various proprietors of house property over which the wires pass, but Mr. Waterlow has rarely met with any difficulty from them; on the contrary, with some unimportant exceptions, has received every facility for carrying his object into effect. With the exception of a very few cases where there were joint or other interests concerned, which could not readily give complete assent, and where it was easier to take the consent of the owner of the next house, Mr. Waterlow has scarcely in any instance had to deviate from the line first proposed. In almost every case a written agreement is entered into to remove the supports and wires at a short notice if required, making good any damage which may have occurred. Mr. Waterlow states the cost to be at the rate of £50 per mile, including poles, wires (double line), insulators, labour, and everything, except the instruments, the whole fixed and painted with three coats of paint in oil.

Mr. Waterlow has adopted a very novel and ingenious mode by which the wires can be painted and the paint renewed, when required, without stopping the current. The cost of painting a double line of wire when necessary is about £4 a mile.

The telegraph used by Messrs. Waterlow is the single-needle instrument, requiring only a single line of wire; the double line is put up, in case it may be hereafter found necessary or desirable for any reason to make use of it, the extra cost of stretching a second line at the same time as the first being comparatively small. The cost of a single-needle instrument is £5; alarums, £4 4s. each.

Mr. Waterlow calculates that the whole of the police-stations and fire-engine establishments in the metropolis might be brought into communication with each other for an outlay not exceeding £5,000. The importance of such a rapid communication can scarcely be over

estimated. The amount spent at present in communications between the police-stations alone must far exceed the interest of the outlay of £5,000. When Mr. Waterlow first proposed connecting the Birchin-lane and London-wall establishments by telegraph, a distance of 1,500 feet, he had an estimate prepared of the cost of laying down subterranean wires for the purpose. The estimate was £1,200; by the method adopted the cost was under £30, exclusive of instruments.

SPIRIT FROM BEETROOT.

In the first report of the Commissioners of Inland Revenue, presented to Parliament last year, the Commissioners in reference to this subject say:—

"The most important matter connected with the Distillery Laws, which has engaged our attention in the course of the last year, is the attempted introduction into this country of a process of distillation from beetroot, which appears to have been adopted to some extent in France. The nature of the process is such, that our present Revenue Laws do not admit of its being carried into operation; but on learning that some persons interested in it wished to try an experiment with it on a large scale at Farningham, in Kent, we conceived it to be our duty to offer no objection or impediment to their proceedings. We have, therefore, allowed full liberty of action to these experimental distillers, but have stationed some careful officers at the works, and have received from them constant reports, explaining in detail the method of working, and all the incidents to it, together with exact accounts of the results which have been obtained.

"These have not hitherto been such as to lead to the belief that the process can be used with profit as a mode of manufacturing spirits. It is, however, asserted by those who have introduced it, that the manufacture of spirits is only a subsidiary object of the invention, and that the value of the spirits, when rectified, will be sufficient to pay the expenses of manufacture and of materials; and that the beetroot from which it has been made may then be used for feeding cattle, improved for that purpose by the process which it has undergone, and a clear source of profit to the farmer. For it is to the farmer that this invention is offered as a valuable addition to his agricultural operations; and if it can be established as a fact that it is so, it will become a matter of serious consideration whether the Distillery Laws can be so altered as to allow the manufacture of spirits in the manner proposed, without danger to the great revenue which is at present derived from that article."

The Commissioners, in their second report presented to Parliament this year carry on the subject as follows:—

"Some account was given in our first report of the establishment of an experimental beet-root distillery. The results obtained were very unsatisfactory, and did not lead us to anticipate any further attempts of the same nature; but Messrs Dray, who made the apparatus, and are licensed by the patentee of the process, represented to us so strongly the necessity of giving a fair scope to their experiment, by trying it on a large scale, and with the produce of various qualities of soil, that we obtained your lordship's leave (not without first ascertaining that the licensed distillers would have no objection), to permit the erection of 12 experimental beet-root distilleries in different parts of the United Kingdom, the selection of places and of persons being left to Messrs. Dray. Only 10 of these distilleries have been in operation, but as none of them have succeeded in producing a saleable spirit, or spirit of any kind in sufficient quantity per ton of root to pay their working expenses according to the calculation of the projectors, it may fairly be assumed that the process can never be successfully adopted in this country. The observations of our officers on the results obtained at each place will be found in detail in the appendix; and it may therefore be sufficient to state here that one of the most enterprising of these experimentalists has recently applied to the Chancellor of the Exchequer for protection against the grain distiller, in the shape of a differential duty of 2s. 6d. in his favour, and has acknowledged that, without some such advantage, it would be impossible for him to make a profit, or even to pay the working expenses of the distillery."

The following is an account of the roots used and spirits produced at the experimental distilleries:—

Where situated.	No. of Weeks at Work.	Globe Mangold and Silesian Beet.	Galls. of Proof Spirits charged with Duty.	Average Number of Gallons per Ton	Spirits Sold.
		Tons Cwt. Qrs.			*Gallons.*
Ruddington (Notts)	9	517 5 0	4,631	8·9	267
Lincoln	16	600 4 0	5,710	9·5	None
Louth (Lincolnshire)... ...	6	835 0 0	4,602	5·5	None
Laxton (Yorkshire)	12	396 12 0	3,435	8·9	None
Fineshade (Northampton)...	13	515 0 0	4,201	8·1	57½
Bolney (Sussex)	10	313 0 0	2,074	6·6	None
Minety (Wilts)	10	758 10 0	7,003	9·2	None
Crowmarsh (Oxon)	12	207 0 0	1,260	6·0	None
Reading (Berks)...	18	460 0 0	4,395	9·5	684
Otford (Kent)	14	224 0 0	1,782	7·9	None
North-end (Middlesex), near Fulham	3	70 0 0	487	6·9	None

Messrs. Ridley and Co., of 27, Crutched Friars, in a letter to the *Times* on this subject, say:—

"It is much to be regretted that some misconceptions prevail respecting the properties of beetroot to yield a fine consumable spirit. In France, during the last three years, millions of gallons have been distilled from this cereal, converted into and freely consumed as Cognac brandy. So far this tends to demonstrate its superiority over grain for spirit-making purposes.

"Beetroot contains from 10 to 12 per cent. of solid saccharine matter, which when, disengaged by maceration and distilled in the ordinary manner, will yield in good seasons 25 gallons of proof spirit from one ton of root. It can be cultivated at a cost of 10s. per ton, and, allowing its value to be augmented to 20s. or even 30s. per ton, when used for distilling purposes, a very handsome profit might be obtained by selling its spirit at 2s. per gallon; besides which the pulp of the root, after being denuded of its saccharine, is in no way deteriorated as cattle-feed; on the contrary, some authorities assert that, being partially cooked, it is then more nutritious.

"Our Inland Revenue laws, in many instances, are found to operate obnoxiously against native enterprise. Why not allow our farmers freely to distil their produce and apply the refuse to fatten cattle, as is the common order of things on the Continent, particularly in Germany? A new field might easily be opened for the cultivation of beetroot, on lands now lying waste, which could be profitably turned to account,—*i. e.* to provide spirit for man and food for beasts, while the highly cultivated grain lands could be more exclusively devoted to their legitimate purpose of raising breadstuffs for the actual wants of our enormous community. We fear, however, that while the Inland Revenue officials evince affection for class interests, the projectors of beetroot distilleries may expect to meet no end of obstacles, created, to a great extent unnecessarily by excisemen to baulk the developments of new projects before obtaining a fair trial."

COTTON SUPPLY FROM AFRICA.

A meeting of the Cotton Supply Association was held in the Manchester Town-hall, on Friday, August 6th, Mr. J. Cheetham, M.P., in the chair, to receive information from Mr. Campbell, her Majesty's Consul at Lagos, as to the prospects of cotton supply from the west coast of Africa. He gave a most encouraging account of the

resources of the districts near the mouth of the Niger, especially as bearing on the objects of the association, and he believed there was every prospect of obtaining thence a large supply of cotton in course of time. This was not the only part of the country from which it might be procured, for cotton actually grew throughout the whole of tropical Africa. When our forefathers clothed themselves in sheepskins and goatskins, the ancestors of the people in that region were clothed as they are now. But the Bight of Benin had been occupied by the slave trade for nearly a century, and by its operation the resources of the country had been shut up. Since the Government had taken the matter in hand, and sent him there in order that British interests might have fair play against the slave-trade, great progress had been made. The palm-oil trade from the Bight of Benin had increased during the last six years by about £600,000 out of £1,000,000. Why should not a cotton trade receive equal development if this country supplied capital for the purchase and skill for the preparation of that important product? The first ship loaded with cotton would give the signal for the whole of the cotton regions of Africa. The people were exceedingly fond of agriculture. In Abeokuta they preferred working in the plantations for 3d. a-day to working at any other employment for 9d. But, hitherto, they had been shut out from communication with civilised countries, and their roads were, at present, mere pathways. He believed the Niger would become the Mississippi of Africa as its trade became developed. At present the cotton from that region had been obtained from Abeokuta only. It was a peculiar feature of this part of Africa that it contained towns of 40,000, 60,000, 80,000, 100,000, and even 120,000 inhabitants, while in other parts there were only scattered villages. The people were not merely growers, but manufacturers of cotton, and from Lagos and the Bight of Benin 200,000 cotton cloths of native manufacture, averaging 2½lb. each in weight, had been exported in the year 1857 to the Brazils or elsewhere. The shipment of cotton from Lagos in 1856 was 34,491 lb., and in 1857 it was 114,844 lb. Small as these beginnings were, it was remarkable how they were progressing. Besides the export, the people supplied their neighbours with at least 200,000 heavy cloths, weighing 4½ or 5lb. each. All this commerce had been established before we had begun to trade with them. He looked forward to our buying the cotton from the natives and their purchasing from us the manufactured article, which we could supply so much cheaper. There was nothing to fear on the score of security to property; Europeans were everywhere received with kindness, and cotton was found exposed for sale in every town at the weekly markets. It might, therefore, be said that it was going a-begging for want of purchasers. What was wanted by the growers and traders was the cheap and rapid means of cleaning the cotton. There was no foundation for the prevailing belief that the free African would not work if he were secured the fruits of his labour. At Lagos the people went to work at daybreak, they took their meals and rest in the heat of the day, and a more industrious people he believed did not exist. He had mentioned the value of labour at Abeokuta, but in other towns it was only 2d. a-day, or 1½d. a-day in the interior. He estimated the population at a million and a-half, and they were all clothed in garments of their own manufacture. He was confident that 4½ lb., taken as the cotton consumption of each person, was an extremely low estimate. In the question of cotton supply to England, it must be remembered that in Africa there was no rent to pay for the land. After referring to the importance of the indigo production of this part of Africa, and to the additional advantages it possessed as regards cotton cultivation, that no lands had yet been cleared exclusively for that purpose, Mr. Campbell concluded by submitting detailed suggestions for the commencement of operations for promoting the cultivation of cotton in the districts in question by sending a respectable man as superintending agent at Abeokuta, with a supply of small presses, gins, an iron store, iron canoes to convey cotton bales between Abeokuta and Lagos, &c. The agent should carry with him £2,500 or £3,000 in suitable merchandise for the purchase of cotton. He should be authorised to buy on the spot from time to time, as wanted, cowrie shells to the value of £250, those being the currency of the country. They were to be had at Lagos at from £22 to £23 the ton. The London and Liverpool market might be tried. The cheap blue shell cowries from Zanzibar were what was required, but care should be taken in selecting them, as, being bought by weight and sold by number, the smaller size shell would be the most profitable. The agent should be authorised to hire native sub-agents for the interior towns, men of good character, and as these did not abound, their services were now valued at from £60 to £80 per annum, they providing for themselves. The agent should be supplied with an iron house, lined inside with board, raised on iron pillars at least 12 feet high. This elevation was essential to health. Mr. Campbell having given satisfactory replies to several questions,

Sir J. Potter, M.P., moved a resolution that the association, with the support of the trade, should endeavour promptly and practically to realise all the great advantages thus perceptibly offered for the important increase in the supply of the raw material which was so much needed.

Mr. Hadfield, M.P., seconded the resolution, which was unanimously agreed to.

Mr. Booker, of Liverpool, and Mr. Henry Ashworth afterwards addressed the meeting, and a resolution of thanks to Mr. Campbell was adopted.

STEAM CARRIAGES ON COMMON ROADS.

The following account, taken from the *New York Herald*, is communicated by Mr. E. G. Squier, of New York:—

"Many of our readers have doubtless noticed the small steam carriage which has been driven about the streets of New York and vicinity within the last nine months. It is an odd looking machine, and has much the appearance of an artillery waggon, from its low size and the projecting boiler, which is not unlike a cannon.

"Is has long been a disputed point whether steam carriages can be navigated safely and successfully on land, and at the same time subserve any useful purpose. The prevailing belief has been that they are entirely useless and impracticable, for it has been deemed incredible that a mode of locomotion so obviously advantageous should not long ago have come into general use were it not for some insuperable difficulty in the way.

"When the wonderful powers of steam were first discovered, it was immediately suggested that it might be used in the propulsion of vehicles on land, and the first experiments with the new motor were with a view to test its use in this way. But all the early attempts proved unsuccessful, although the ingenuity of the best mechanics of Europe was brought to bear to solve the problem. This is not the place to detail the numberless experiments in steam carriages which have been made from time to time. Suffice it to say that none have been acknowledged as successful by the public, whatever the opinions of the several inventors may have been. It is indeed claimed that more than one carriage has been built in England that would answer every purpose for which they were designed, but that popular prejudice, the opposition of stage proprietors, or the poverty of the inventor, have prevented them coming into general use.

"The carriage which has been propelled through the streets of New York for some time past, was invented by Mr. Richard Dudgeon, a mechanic, of English birth, but who learned his trade in America. He is the inventor

of the portable hydraulic jack, which is well known to steamboat men, and also of other minor applications of hydraulic power. He is simply a good locomotive machinist, knows nothing of the history of previous attempts in the making of steam carriages, and is unable to explain wherein his carriage differs from others, except that it promises to be successful, while it is certain that all former ones have not been deemed so.

"Mr. Dudgeon's carriage weighs 2,700 lbs., and may be described as a half or quarter sized locomotive, with very large wheels and no smoke pipe. It has no peculiarity in the arrangement of the steam machinery, which is a simple tubular boiler with improved valve gear. The cylinders are fastened to the front of the boiler or smoke box at the usual angle, and have inside connections to the crank. The steam is distributed to the pistons by a modern slide valve, and the link motion perfected by Stephenson. The steam and smoke are discharged downwards, in front, without a chimney, and pass behind a water tank on the front end of the boiler. The cranks are worked on the inside instead of the outside, as in other locomotives. The improvement over other engines consists in increasing the stroke of the piston, and diminishing the size of the driving wheels. The stroke is eighteen inches, and the diameter of the wheels three feet and a half.

"The carriage wheels are very similar to those in ordinary use, only smaller, to diminish the jolt. The hind axle, to which the steam power is applied, is an ordinary crank axle. The steering is done by the front wheels, and with great ease and certainty, there being no difficulty in steering through the most crowded streets in New York. The steering is accomplished by a stout iron rod, armed with a screw at one end, which moves the front axle according to the direction it gets from the cranks, and is under the control of the driver, who sits behind the boiler. The axles are at either end of the boiler, so that it may be kept low and a long wheel base obtained, which makes it run very steady over a rough pavement.

"Upon invitation of Mr. Dudgeon, one of our reporters took a trip with him in his steam carriage to Harlem some time since. The day was unpropitious, as the road was bad from the recent rains, and there was but little opportunity to test the speed of the carriage, as compared with the fast horses that frequent the avenues. It is not pretended that this carriage will run on a soft road; its great weight (2,700lbs.) would render it impossible to make any progress. It is imperative that the road should be hard and even; and should these vehicles ever come in use, roads must be made for their accommodation. An ordinary tram road—that is, boards laid lengthways, for the wheels to run upon—would, the inventor claims, do very well for all practical purposes. The party, which consisted of the inventor, our reporter, and a lad to attend the engine, started from Goerck-street about two in the afternoon, and proceeded up Grand-street on the Belgium pavement, over which the carriage rolled quite easily, with a jolt very similar to that of an omnibus. Although it met numberless carts on the journey, there was no collision, as it could be managed with much greater ease and certainty than a horse and waggon. In its progress it of course attracted great attention, every one stopping on the walk to look at it. The majority evidently regarded it as a good joke, and thought it incumbent on him or her to laugh at it in passing. The juveniles, however, were its most ardent admirers, and on the outskirts of the city they fairly swarmed about the (to them) novel vehicle, and were clamorous for a ride.

"The route taken was up the track of the Second Avenue Railroad to Harlem and back again to Grand-street, a distance that was accomplished in less than two hours, with frequent stoppages, though there was no effort made to run fast. The distance to Harlem and back could easily have been run in an hour, provided the track had been clear and there had been no impediments. The cars were easily outrun, and a boy on a fine white horse, who attempted to keep up with the steam carriage, was left behind in a few minutes. The carriage also travels very readily on an inclined plane. The hill on the Second Avenue above Fortieth-street, seemed to offer no serious obstruction, nor did that at the other side of Jones' Wood. The inventor claims that it will easily ascend a hill 600 feet per mile, and there is reason to believe that it will do so. From the speed attained it was evident that twelve miles per hour could be run easily, provided all was in condition, clear, hard road, &c.,; and this, of course, leaves a margin for improvements in the construction of other steam vehicles.

"The cost of the machine under notice is 1,500 dols. It requires two persons to manage it; a lad, however, is quite as competent as a grown person for this duty.

"There is one objection to these carriages—at least, in crowded cities—that will yet raise a great outcry against them, and that is, the alarm they cause among horses. These sensitive animals will manifest fear at their approach, and serious consequences will some day ensue. Well trained horses pay very little attention to the novelty, but all horses are not well trained, and hence the difficulty. It is true that this machine has been run in the streets of New York for the last nine months without any accident occurring, but should any difficulty transpire, the proprietors of horses would be unanimous in putting a stop to it within the city limits.

"Should, however, these steam carriages come into use, it will be on roads made for the purpose, for travel between points that would not support a railroad. There are plenty of such in the country, and should these machines prove practicable, they will make a tremendous revolution in the modes of travel through the country."

SOUTH KENSINGTON MUSEUM.

During the week ending 7th Aug., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,427; on Monday and Tuesday (free evenings), 4,489. On the three Students' days (admission to the public 6d.), 791; one Students' evening, Wednesday, 92. Total, 8,799.

Home Correspondence.

THE SOCIETY OF ARTS EXAMINATIONS.

Sir,—Notwithstanding the great number of Local Boards of Examiners at the last Examination, and the consequent difficulty of uniformity of action which might have been anticipated, such were the admirable arrangements of the Council and the precise directions given to each Board, that the whole may be considered eminently satisfactory, whilst the number of Certificates which were awarded afforded an abundant proof of the great importance of this valuable aid to our numerous Mechanics' Institutions. In order, however, to give a greater prospect of permanence to the movement, it is requisite that the formation and proceedings of the Local Boards should be of a more systematic character; and if the appointment of the Examiners were more immediately with the sanction or cognisance of the Council of the Society, it would tend materially to give them importance and efficiency. At the recent Conference it was admitted that, owing in a great measure to such appointments being altogether entrusted to local management, there were several discrepancies which might, by better arrangement, have been avoided. I allude more particularly to the fact of two Boards sitting at Leeds, three at Halifax, &c., and the resulting inconvenience of the

number of Examiners occasionally exceeding the number of students to be examined.

I would suggest that, in every locality where it is intended to hold an Examination, communication should be made with the Society of Arts, and the names of the proposed Examiners submitted for approval, so that, in the event of more than one Institution pursuing the same course, a joint action may be promoted. In all large towns there should also be no difficulty in selecting a number of gentlemen both able and willing to undertake the several departments, and if the appointments were confirmed by the Society of Arts, it would give the Local Board a status in its locality which could not fail to be of advantage. In places where more than one Institution exists, the Committee of each might ascertain the comparative fitness to undergo the ordeal of any of their members desirous of being examined, so that preliminary arrangements might be made accordingly.

With a Local Board extending its services over a particular district, some advantage might be gained by occasional inspection, and such suggestions made as would direct the attention of students to the proper channels by which they may have the best prospect of success. This can be done far better by a Local Board systematically organised for a specific duty, than by the imperfect efforts of the officers of Institutes, who are too often little acquainted with the necessary formulæ. A Board in direct communication with the Society of Arts would be a reference for advice always accessible, and obviate many of the difficulties so often felt by young men who are desirous of improvement, but do not know how to proceed.

In all such matters publicity is one of the main elements of success, and though much has been done in this respect, there is much which remains to be done before the Society of Arts Examinations can be considered a national institution, entitled to that large share of public support which, if they were better known, they could not fail to receive. I would suggest that after the formation of a Local Board of Examiners, the list should be publicly announced by printed bills and advertisements in local newspapers, which should also set forth the several subjects in which Candidates would be examined, the times and places of the preliminary and final examinations, the conditions to be observed, and such other particulars as would enable the student to avail himself of the opportunity. I shall not adduce instances of the want of publicity, for the fact will be generally admitted, and few will be prepared to dispute that much benefit may be gained from the course I have suggested.

To the Committees of such Institutions as are in union with the Society of Arts, I would recommend that they at once take steps to unite with other Institutions in the same town or within a reasonable distance, for the selection of Examiners, that the selection having been made and approved, the fact be made as public as possible, and that such preparations for a Local Examination be immediately followed by the formation of classes, either on the principle of mutual improvement, or under competent teachers for the especial preparation of candidates. If such a course be followed in only the principal towns throughout the Kingdom, a much greater impetus will be given to the movement than it has yet received, and the good effects will be apparent not only in the moral and social advancement of those who are immediately affected by it, but still more in the greater number who will be stimulated to mental cultivation in the place of sensual gratification.

Many are the complaints that Mechanics' Institutions have not accomplished the objects for which they were designed; that the operative classes will not take advantage of the opportunities they afford, and that many have become merely circulating libraries and lecture halls. The complaint may be in two many cases well founded, but if there be anything which promises to restore these Institutions to their original purpose—the dissemination of Science and Literature amongst the working classes—it is the encouragement to exertion and the help to elevation afforded by the Society of Arts Examinations. It is a duty therefore incumbent on the managers of all such Institutions to do their utmost to render the plan successful, and to bear in mind that whilst the Society of Arts takes the initiative, organises the movement, and gives to the certificates of Examiners a local habitation and a name, no benefit can be derived without the cordial co-operation and active exertion of local authorities.

I am, &c.,
BARNETT BLAKE.

Leeds.

Proceedings of Institutions.

London, Royal Polytechnic Institution Evening Classes.—A meeting took place on Tuesday afternoon, the 27th July, in the Board-room of this Institution, to consider the propriety of carrying on the evening classes next winter. After some discussion the following gentlemen were elected a committee of management:—The Hon. Captain Maude, R.N., Rev. J. B. Owen, Mr. Longbottom, Dr. White, and Mr. Hagreen. Mr. Buckmaster was elected hon. secretary. The classes will meet the first week in October.

Nottingham.—The twentieth annual report of the Mechanics' Institution shows that its affairs have assumed a more encouraging aspect than they have exhibited for the last two or three years. As this result has been brought about during a period particularly adverse to institutions maintained by voluntary subscriptions, it may, in some measure, be attributed to those important alterations in the management which the Committee have effected within their term of office, and which, they have reason to believe, have been regarded with great satisfaction by the members at large. In the library department a fundamental change has been effected. Additional space has been obtained for the exhibition of books, by removing the partition wall of the reading-room, and thus facilitating reference and examination. Free access to the books is now allowed, and the plan of selecting books from a catalogue, and then applying to a librarian, which had been found to be inconvenient and tedious, has been abolished. So far as is known to the Committee, there has not, at present, been any abuse of this privilege. Valuable works of reference are more frequently consulted by the members, who appear to take greater interest in the library than they did previously to the alteration referred to. The issues of books and periodicals have been as follows:—

Class.	Vols.	Issues.		
A. History and Biography	930	4,051	decrease	115
B. Voyages, Travels, and Geography	702	2,340	increase	110
C. Philosophy, Science, and General Literature	1,492	2,989	increase	47
D. Miscellaneous	476	4,145	decrease	12
E. Poetry and Works of Fiction	1,388	14,051	decrease	1043
F. Theology and Moral Philosophy	235	775	increase	57
G. Bound Magazines	984	2,430	increase	39
H. Works in Foreign Languages	70	255	decrease	5
Works of Reference	65	108	increase	4
	6,342	31,144		
Unbound Parts and Periodicals		2,275	increase	325
		33,419		

These returns are very similar to those of the previous year. The demand for works in the first three classes, comprehending history, travels, and the sciences, appears to have been sustained throughout the year, whilst there is again a large decrease in the issues of works of fiction. As a greater number of books have been added to class E than to any of the other classes, this continued falling off cannot be ascribed to the want of new works, and may be really regarded as indicative of a higher standard of reading amongst the members. 206 volumes have

been added to the library; of these 29 have been presented, and 177 purchased. The members are indebted to the President (the Right Hon. J. E. Denison, M.P.), the Mayor (Mr. Alderman Heymann), and Mr. Arthur Morley, for donations of books. The course of lectures during the year has been as under:—Jan. 20, "Christmas Carols," Mr. W. Fyfe; Feb. 3, "Possible Education," Mr. J. A. Nichols, Manchester; Feb. 17, "British India," Rev. G. Smith, Poplar; Mar. 10, "The Fate of Genius," Mr. H. B. Campbell; April 14, "The Interest attached to the Study of Natural History," Mr. E. J. Lowe, F.R.A.S.; April 28, "Memory as a Power of the Mind," Rev. S. J. Sargent, B.A.; Nov. 10, "Prisons and Prisoners," Rev. S. McAll; Dec. 15, "The Past and the Present, or Steam the Civiliser," Rev. G. W. Conder, Leeds. The custom of former years has been again observed by the Committee, free admission having been given to members of local institutions of a like character, who have availed themselves of the opportunities thus afforded in considerable numbers. On this account most of the lectures have been delivered in the large hall. In the French Classes, under Monsieur Durand, there are 18 students. The Committee are happy to report that the classes continue to be most efficiently conducted by the teacher. An elementary class assembles first in the evening, and a class for conversation at a later hour. The Discussion Class has about 40 members, the same number as reported last year, one-half of whom attend the weekly meetings. The subjects which have recently occupied the attention of this class are as under:—"British Rule in India;" "Is Education the Duty of the State?" "Is Phrenology True?" "The Principal Causes of General Distress;" "Sydney Smith, Essayist and Wit;" "Which should Exalt a Man the most, the Good Qualities of the Head, or those of the Heart?" "Magna Charta and the Bill of Rights;" "The Grant to Maynooth, ought it to be Abolished?" "The Decline of States;" "Astronomy." The Chess Class is reported as being in a flourishing condition, and affording evidence of considerable progress. There are 22 members connected with it. In the last report, reference was made to the formation of classes for the study of those subjects in which public examinations are held by the Society of Arts. Several gentlemen were solicited to co-operate in the establishment of one or more classes, and the request of the Committee was most thoroughly and liberally responded to. Accordingly, Dr. Wilson, during the Summer months, gave a course of eighteen lectures on Practical and Physical Botany; but, the Committee regret to say, that only five members entered the class. Dr. Robertson kindly undertook to deliver a course of thirty lectures on Theoretical and Practical Chemistry. Thirty-five students formed the class, twenty-three of whom were members of the Institution. After having given the second lecture, Dr. Robertson was, unfortunately, prevented by illness from continuing the course. With reference to the museum, the Committee have signed an agreement with the Working Men's Natural History Society, by which the future management of this department is vested in the members of that Society and the Museum Committee of the Institution. Free admission has been secured to the members of the Institution at all ordinary exhibitions. A catalogue of the specimens belonging to the Institution has been made. Portions of the museum have been re-arranged, and the Society are now exerting themselves to render the museum worthy of public notice, and suitable for the study of the naturalist. Every Tuesday evening the members meet for discussion, when a paper is read on some particular branch of Natural History. It is the wish of the Society to secure a sufficient amount of subscriptions to enable them to have the Museum constantly open to the public, and to supply such additions to its specimens as will make it equal to any provincial museum. A number of valuable Geological specimens have already been received from the Government. The Society possesses a library, consisting exclusively of works on Natural History. The ordinary members of the Institution are classified as under:—Professional men and manufacturers, 74; shopkeepers and tradesmen, 84; clerks, shopmen, and warehousemen, 285; journeyman lace and stocking-makers, 16; journeyman joiners, bricklayers, masons, &c., 13; journeyman smiths, machinists, and workers in metals, 16; journeyman shoemakers, tailors, printers, &c., 17; journeyman butchers, bakers, servants, and labourers, 14; artists, designers, schoolmasters, and excisemen, 24; youths under 21 years of age, 52; females, 97; subscribing honorary members, 171; life honorary members, 89; total 952. These figures show an increase of 11 members as compared with the return of the previous year. Although this increase is small, it is most encouraging, after the successive diminutions which it has been the duty of the Committee to report. 63 members have transferred their shares, and 86 persons have joined the Institution. The transfers are 7 more than last year, and the admissions give an increase of 25. The statement of accounts shows that there is an amount of £59 4s. 3d. due to the Treasurer, which is a reduction of £26 14s. 1d. as compared with the debt of last year. Several items of expenditure are such as are not likely to occur again, at least, for some years. The alterations in the library, and the painting and repairs of the building, have involved an outlay of £71 10s., of which the sum of £27 3s. has already been paid.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Aug.* 6, 1858.]

Dated 1st May, 1858.

974. J. Phymoni, Crooked-lane—Imp. in apparatus for catching fish in tidal rivers and other water courses.

Dated 29th June, 1858.

1462. E. Stevens, 5 and 6, Cambridge-road, Cambridge-heath—An improved cooking utensil.

Dated 8th July, 1858.

1530. J. F. Stanford, Howard-street—A new and improved method of and apparatus for applying heated air in drying corn, hay, and other like articles, in the stack or otherwise, and in drying goods, and in heating and drying rooms and buildings.

Dated 9th July, 1858.

1546. G. Parsons, 50, High-street, Lambeth—Imp. in apparatus for the prevention of injury to and the sudden bursting of steam boilers.

1548. F. Sang, 42, Charing-cross, and T. W. Rammell, 16, Spring-gardens—Imp. in the means of conveying letters and parcels from one place to another.

1550. F. H. Edwards, Gateshead-on-Tyne Iron Works—Imp. in pneumatic springs for railway carriages and other purposes.

1552. W. E. Newton, 66, Chancery-lane—Imp. in the construction of umbrellas and parasols.

Dated 10th July, 1858.

1554. G. H. Wain, Liverpool—Imp. in reefing and furling sails.

1556. J. F. Watson, 3, Lonsdale-villas, Bayswater, and V. B. Fadeuilhe, Newington crescent—Imp. in the preparation of cocoa and chocolate, and also of nutritive compounds from the seeds of the plant called Soja Hispida and Cicer Arietinum.

Dated 12th July, 1858.

1560. J. Macintosh, Aberdeen—Imp. in apparatus for the manufacture of articles of confectionery.

1564. D. S. Wilton, 30, Tibberton-square, Lower-road, Islington—Imp. in pianofortes.

1566. J. Taylor, Roupell-park, Streatham-hill—Imp. in the manufacture of blocks for the construction of sewers, drains, and arches.

Dated 13th July, 1858.

1568. E. Chard, Islington—Imp. in pianofortes.

1570. J. A. Fussell, Birmingham—A new or improved method of ornamenting chandeliers, pendants, and brackets, for gas and other lamps, which method of ornamenting is also applicable to curtain bands.

1572. J. Edwards, 77, Aldermanbury, London, and T. Newey, 70, Navigation-street, Birmingham—Imp. in the manufacture of blind furniture.

1574. G. Buchanan, 29, Bucklersbury—Imp. in sugar cane mills.

1576. W. Beadon, Otterhead, Honiton—Imp. in the manufacture of bags for corn and other articles, and sails for ships.

Dated 14th July, 1858.

1580. W. Woodcock, 36, Great George-street, Westminster—Certain imp. in apparatus for warming air.

1582. J. Cowan, Liverpool—An improved screw nail.

1584. J. Jones, City Water Works, Oxford—Imp. in meters for measuring liquids.

1586. T. Wheeler, Albion Iron Works, Oxford—An improved combination of machinery for cutting, slicing, grating, and pulping turnips, mangold wurzel, and other roots.
1588. T. Wheeler, Albion Iron Works, Oxford—Imp. in washing, wringing, and mangling machines.

Dated 15th July, 1858.

1592. C. W. Williams, Liverpool—Imp. in locomotive and other boilers for giving them increased power in generating steam.
1596. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the mode of covering cotton, woollen, and other thread with silk, and in the apparatus connected therewith. (A com.)
1598. A. H. J. Bastable, Belgrave Works, Ranelagh, Pimlico—Imp. in apparatus employed in the production of light. (A com.)
1600. P. Fairbairn, Leeds—An imp. in lathes. (A com.)
1602. W. Betts, Wharf-road, City-road—Imp. in the manufacture of capsules and in the apparatus to be employed therein.

Dated 16th July, 1858.

1604. F. Priestley, 15, Berners-street—Imp. in condensing steam engines.
1606. M. Voss, 12, Billiter-square—Safely submerging ocean telegraph cables and other heavy bodies in rivers, lakes, and seas, by means of inflated buoys and connecting gear.
1608. A. P. Price, Margate—Imp. in the treatment and smelting of certain ores or compounds of tin, and of tin, and of certain alloys thereof.
1610. T. F. Chorley, 9, Cottage-place, City-road—Improving the form of bankers' cheques, and other similar documents, with the view of preventing fraudulent dealings therewith.

Dated 17th July, 1858.

1612. T. Hart, Glasgow—Imp. in taps or valves, and in apparatus for regulating the flow of fluids.
1614. J. T. Smith, Dudley, Worcestershire—A new or improved manufacture of coke.
1616. R. A. Brooman, 166, Fleet-street—Imp. in apparatuses for the reception of fecal and sewage matters, and in the treatment of fecal matters. (A com.)
1618. W. A. Lloyd, Portland-road, and E. Edwards, Menai-cottage, Anglesea—Imp. in aquaria tanks and similar receptacles for aquatic animals and plants.

Dated 19th July, 1858.

1619. J. J. Desmares, Vire, France—A new process for oiling wools.
1621. C. Bray, 14, Alfred-terrace, Queen's-road, Bayswater—Imp. in ice safes.
1622. H. Smith, Brierly Hill Iron Works, near Dudley—An imp. or imps. in the manufacture of harrows.
1623. C. Reeves, Birmingham—Imp. in repeating fire-arms.
1624. T. Greenwood, J. Batley, and J. Salt, Leeds—Improved machinery for preparing silk to be spun.
1625. J. W. Wilson, Duke-street, Adelphi—An improved preparation of materials to be used for roofs and other parts of buildings, and for various purposes for which wood is now generally employed.
1626. W. Tasker, jun., Waterloo Iron Works, near Andover—Imp. in combined thrashing machines.
1627. T. F. Chorley, 9, Cottage-place, City-road—Imp. in the form of bankers' cheques, and other similar documents, with the view of preventing fraudulent dealings therewith.
1628. W. Herapath, Bristol—An imp. in the manufacture and treatment of paper with the view to the prevention of forgery.
1629. C. Lambert, Sunk Island, Yorkshire—Imp. in collars for horses and other draught animals.
1630. S. Maw, Aldersgate-street—An improved feeder for administering food.

Dated 20th July, 1858.

1631. J. Schmitt, Guernsbach, near Radstadt, Baden—Cementing, hardening, and tempering rails for railways, and also axles for railway carriage wheels.
1632. J. Chadwick, Castleton Print Works, near Rochdale—Imp. in the application of certain woven fabrics to printing purposes.
1633. J. Shand, Blackfriars-road—Imp. in fire-engines and pumps.
1634. T. Bailey, New Orleans, U.S.—Imp. in repeating fire-arms.
1635. J. C. Hill, Kentish-town—Imp. in making joints for connecting pipes and other articles by means of lead or other soft metal.
1637. C. Doley, Birmingham, and E. Bigland and H. Worrall, Smethwick—Imp. in ornamenting metallic and non-metallic surfaces.
1638. G. Wheatley, Bethnal Green-road—An imp. in the ornamenting of sticks.
1639. R. A. Brooman, 166, Fleet-street—Imp. in movable apparatuses for receiving fecal and sewage matters. (A com.)
1640. W. N. Nicholson, Newark-on-Trent—Imp. in crushing mills.

Dated 21st July, 1858.

1643. E. Hardon, Stockport—An improved manufacture of woven fabric for covering umbrellas and parasols.
1644. J. W. Wilson, Barnsley—Certain imp. in machinery or apparatus for turning and cutting wood and other substances.
1645. M. Matley, Ashton-under-Lyne—Imp. applicable to steam boilers for consuming smoke and economising fuel in the generation of steam.
Paris—An improved propeller.
rdeaux, France—Imp. in calculating machines.
7, Fleet-street—A vehicle for lamplighters.
St. Martin's-le-Grand—Imp. in locomotive or
es.
ow-hill—Imp. in wet gas meters.

Dated 22nd July, 1858.

1651. D. W. Warder, 4, Caroline-place, Chelsea—Imp. in the manufacture of beams, girders, ships' ribs or frames, and other structures of wrought iron.
1652. B. Blake, Eccleston, near Prescot, Lancashire—An improved kiln for burning earthenware and other similar articles.
1653. H. Green, Liverpool—A new or improved hinge for hanging and closing doors, gates, or windows.
1654. C. Gammon, 9, Cloak-lane—Imp. in the fastening of envelopes and letters.
1655. W. L. Thomas, Union-street, Berkeley-square—Imp. in ordnance, fire-arms, and apparatus generally in which gunpowder is employed.
1656. J. B. P. A. Thierry, jun., Paris—Imp. in furnaces.
1657. A. B. Tripler, 1, Michael's-grove, Brompton—Imp. in obtaining products from a species of asphaltum at present found in the island of Cuba, and called Chapafote.
1658. H. Higgins and T. Whitworth, Salford—Imp. in machinery for spinning and doubling or twining cotton and other fibrous materials.

Dated 23rd July, 1858.

1659. L. J. Marks, Newport, Monmouthshire—Imp. in compasses.
1660. W. A. Gilbee, 4, South-street, Finsbury—An improved rotary engine. (A com.)
1661. R. P. Walker, New York, U.S.—Imp. in machinery for hulling and finishing rice and similar grains.
1662. H. Barber, Leicester—Improved machinery for producing knitted fabrics.
1663. G. Brockelbank, 71, Lombard-street—Imp. in laying submarine cables for telegraphic purposes.
1664. W. Parsons, Pratt-street, Old Lambeth—Imp. in separating the solid matter from sewage waters.
1665. H. J. Giffard, Paris—Imp. in feed apparatus for steam and other boilers, which improvements are also applicable to the raising and forcing of fluids.

Dated 24th July, 1858.

1666. C. Atkinson, Sheffield—A certain imp. in Venetian blinds.
1670. S. Townend, Blossom-street—Imp. in cranes.
1671. J. F. Belleville, Paris—An improved smoke-consuming apparatus or furnace.
1672. H. C. Traphagen, New York—Imp. in ladies' skirts.

Dated 26th July, 1858.

1674. D. Adamson, Newton Moor Iron Works, Hyde—Imp. in hydraulic apparatus for raising and lowering heavy articles, and in the application of hydraulic power for rivetting metallic structures, as iron ships' boilers, tanks, and similar articles.
1676. C. F. Vasserot, 45, Essex-street, Strand—Imp. in glass-roofs, skylights, windows, and other glass structures. (A com.)
1676. A. Sax, Paris—Imp. in wind musical instruments.
1677. J. Cooke, Belfast—Imp. in singeing, treating, or finishing textile fabrics.
1678. J. Hardie, Stirling, N.B.—Imp. in apparatus for regulating the flow or passage of fluids.
1679. J. Taylor and J. Nimmo, Glasgow—Imp. in healds, and in machinery or apparatus for making healds.
1680. B. T. S. Harris, Brooklyn, New York—Imp. in registers for indicating the presence or absence, and the time of arrival and departure, of workmen or employées.
1681. C. de Jongh, Cautenbach, France—An improved system of and machinery for heckling or combing flax, silk, or other fibrous substances.
1682. T. Hall, Mildmay-park, Islington—Improved apparatus for indicating a rise of temperature in confined spaces.

WEEKLY LIST OF PATENTS SEALED.

August 9th.

254. A. Chambers and W. H. Champion.
256. R. Bell.
257. G. A. Barrett, W. Exall, and C. J. Andrews.
259. C. Johnson and G. Johnson.
268. J. Clifton.
274. J. Macintosh.
276. J. E. Ruffel.
277. J. C. H. Sievier.
285. J. Tall.
291. J. Garnett.
295. T. B. Daft.
302. P. Heyns.
307. E. Cuvelier.
325. W. Clark.
436. C. Eyland.
448. G. Davies.
460. P. A. Cap.
489. J. Young.
586. A. V. Newton.
692. A. Pelez.
704. A. Pelez.
705. V. Gache, sen.
707. A. Pelez.
796. R. A. Brooman.
1102. S. Higgs, junr.
1107. A. A. Croll.
1115. J. Bottomley and A. H. Martin.
1144. J. Foot.
1208. J. Shuttleworth.
1212. S. Rockett and J. J. Reynolds.
1238. D. Service.
1346. J. H. Johnson.

Patents on which the Stamp Duty of £50 has been Paid.

August 3rd.

1683. R. P. Huthnance.
1763. H. J. Betjemann.
1774. J. Macintosh.

August 4th.

1784. C. Bedells.

August 5th.

1785. S. C. Lister.
1787. J. H. Johnson.
1796. R. B. Cooley.

August 6th.

1786. J. A. Manning.
1879. A. R. Le Mire de Normand.

Journal of the Society of Arts.

FRIDAY, AUGUST 20, 1858.

BOARD OF ARTS AND MANUFACTURES, CANADA.

By a statute of the Canadian Legislature, passed last year, reciting that it is "desirable to promote the development of mechanical talent among the people of this Province, by disseminating instruction in mechanics and the kindred sciences, and by affording increased facilities for the study of models and apparatus; and" that "for the attainment of this object by these means, it is expedient to provide for the establishment of Central Boards of Administration in Upper and Lower Canada respectively, connected and co-operating with the Mechanics' Institutes of the several cities, towns, and villages in the pursuit thereof; and to extend encouragement to arts and manufactures, and stimulate the ingenuity of mechanics and artizans by means of prizes and distinctions, distributed and awarded on the same principle as has been already so successfully applied to the encouragement of agriculture in this Province," two "Boards of Arts and Manufactures," one for Upper Canada and the other for Lower Canada, have been established. These Boards are created corporate bodies, and consist of the Minister of Agriculture for the time being (who shall be *ex officio* a member of each), of the Professors of and Lecturers on the various branches of physical science in all the chartered Universities and Colleges in Upper and Lower Canada respectively, and the Chief Superintendents of Education in Upper and in Lower Canada respectively for the time being, *ex officio*, the Presidents for the time being of and one Delegate from each of the Boards of Trade, and the Presidents of and Delegates from each of the incorporated Mechanics' Institutes, or of any incorporated Arts Associations.

Each incorporated Mechanics' Institute in Upper and Lower Canada respectively elects and accredits to the Board of Arts and Manufactures in each Province respectively one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and having paid a subscription of at least five shillings each to its funds for the year then last past; provided that no such Mechanics' Institute shall be entitled to elect and accredit any such delegate to the Board of Arts and Manufactures, unless it shall have paid and contributed to the funds of such Board, at least one-tenth of the amount of Government aid granted to such Institute during the year then last past.

The duties of these Boards of Arts and Manufactures are to take measures, with the approbation of the Minister of Agriculture, to collect and establish at Toronto and Montreal respectively, for the instruction of practical mechanics and artizans, museums of minerals and other material substances and chemical compositions, susceptible of being used in mechanical arts and manufactures, with model rooms appropriately stocked and supplied with models of works of art, and of implements and machines (other than implements of husbandry and machines adapted to facilitate agricultural operations) and free libraries of reference, containing books, plans, and drawings, selected with a view to the imparting of useful information in connection with mechanical arts and manufactures, to take measures to obtain from other countries new or improved implements and machines (not being implements of husbandry or machines specially adapted to facilitate agricultural operations), to test the quality, value, and usefulness of such implements and machines, and generally to adopt every means in their power to promote improvement in the mechanical arts and in manufactures in the Province; and the Minister of Agriculture may cause duplicates or copies of models, plans, specimens, drawings, and specifications deposited in the Patent Office, and upon which Patents of Invention have issued, to be made, from time to time, and placed in the model rooms, museums, or libraries of the said Boards of Arts and Manufactures respectively; and it shall be lawful for the said Boards respectively, with the consent and approbation of the Minister of Agriculture, to establish in connection with their respective museums, model rooms or libraries, schools of design for women, on the most approved plan, and furnished and supplied in the most complete and appropriate manner that the funds at their disposal may admit of, regard being had to the claims thereon of the other objects for which they are hereby established; and also to found schools or colleges for mechanics, and to employ competent persons to deliver lectures on subjects connected with the mechanical arts and sciences or with manufactures; and the said Boards shall keep records of their respective transactions, and shall from time to time publish, in such manner and form as to secure the widest circulation among the Mechanics' Institutes, and among mechanics, artisans and manufacturers generally, all such Reports, Essays, Lectures, and other literary compositions conveying useful information, as the said Boards respectively may be able to procure, and judge to be suitable for publication. The members of the Boards of Agriculture and of the Boards of Arts and Manufactures, the Presidents and Vice-Presidents of all lawfully organised County Agricultural Societies, and of all Horticultural Societies, and all subscribers of five shillings annually to the funds of any such Society, in their respective sections of the Province, are by the Act constituted an Agricultural Association for that section. The members of the Board of Agriculture and of the sub-committee of the Board of Arts and Manufactures, and the Presidents and Vice-Presidents of County Societies, and of all Horticultural Societies (or any two members whom a County or Horticultural Society may have appointed Directors instead of its President or Vice-President), are constituted the Directors of such Agricultural Association. These Associations are directed to hold an annual Fair or Exhibition, open to competitors from any part of the Province. Power is given to the municipality of any city, town, village, county or township, to grant money or land in aid of the Agricultural Association for that part of the Province to which the municipality belongs, or of any Agricultural or Horticultural Society whatever duly organised under this Act, or of any incorporated Mechanics' Institute, within the limits of the municipality.

The appendix, annexed to the last quarterly report of the Board for Lower Canada, contains the following paper on the Education of Mechanics, to which they desire to give publicity and wide circulation:—

"The development of the industrial resources of any country should be one of the highest aims of its statesmen and legislators. The duty of governments to foster and promote, if not directly to regulate, the education of the people, is now almost universally recognised among civilised nations. In Canada both these patriotic objects are exciting attention in a greater degree than ever heretofore. It is desirable at present to call public attention to the best means of bringing educational efforts to bear directly upon the development of those resources of the country which fit it to become the seat of important manufactures.

"Abundant water power—inexhaustible mines of iron and other metals and economic materials, almost limitless forests of valuable timber, fertile grain fields from which to feed operatives more cheaply than they can be fed elsewhere; districts densely settled with a population admirably adapted by its docility and ingenuity for factory hands, and (because almost altogether debarred during a long winter from agricultural pursuits), willing to work at a lower rate of wages than the usual standard

upon this continent,—all constitute advantages for the establishment and growth of manufactures which have induced men to plant them here, and must conduce to their successful prosecution. But in a contest waged against the large manufacturing establishments of other countries, long established and supplied with abundant capital, these advantages are not alone sufficient to secure success. It behoves Canadians not only to take steps to secure a more abundant supply of capital, and as soon as possible a larger market, but to make every necessary exertion to enable the classes desirous of embarking in manufacturing pursuits to become acquainted with the best processes now in use, and with all the improvements of process and machinery hereafter made, and to furnish them with opportunities of obtaining an education specially fitting them for manufacturing pursuits.

"It was, doubtless, with such an end in view that the Provincial Parliament at its last Session passed an Act for the establishment of Boards of Arts and Manufactures for both sections of the province. Those Boards have been formed in conformity with the provisions of the statute, but as yet have been necessarily little more than skeletons, unable, for lack of means, to enter upon operations likely to give them extended usefulness.

"Heretofore, Parliament has divided its grants for educational purposes into two classes, viz:—that for rudimentary education in common schools, and that for superior education in grammar schools, colleges, and the universities. Few of those destined to become mechanics or factory hands have enjoyed the benefit of any but the common school education; very many not even of that. As a sort of supplementary educational grant intended for those classes, sums have been annually voted for Mechanics' Institutes. But in very many—if not in the vast majority of those institutions, no attempt has been made to furnish any education specially adapted for the improvement of mechanics in the prosecution of their calling. In a few, evening classes have been established, at which lads have been able to make up for the loss of common school education; reading rooms have been fitted up and stored with political, religious, and literary newspapers, libraries of miscellaneous literature gathered together, and lectures *de omnibus rebus*, delivered; but in only a very few instances have studies been pursued, or educational efforts persistently directed into a course likely to be directly useful to the mechanics' or manufacturers' career. There can be no doubt that even the rudiments of education are useful *per se* to the mechanic as well as to all other men; that hearing lectures and reading books on history or *belles-lettres* will serve to render him a more intelligent man; will stimulate a spirit of inquiry and a love of reading which may perchance be attended with the happiest results. But it is not less certain that the usefulness of the sums granted to those institutions would be very much increased, if steps were taken to furnish mechanics with the means of such an education in science as would specially fit them for their calling, in the same manner as the members of the learned professions of the law, physic, and divinity, are trained at the Universities, and school teachers at the Normal Schools.

"Hitherto science and the mechanic have been kept apart. The University man studies mechanics and the other sciences so necessary for the working man's success in life, but the bounty of Parliament has not enabled the poor apprentice to receive the benefits of such instruction. It is time to remove this anomaly from the educational system of Canada. In England, where education is left so much to voluntary effort, the Society of Arts, with its numerous affiliated institutions,—Mechanics' Institutes and Working Men's Colleges,—is using strenuous and successful exertions to afford instruction in the sciences to the working classes. In Paris, for these many years, the Institution of *Arts et Metiers* has furnished such instruction free to the working classes of the French metropolis. It were a shame to us in this new country if we did not use like efforts, and, to the extent of our means, like instruments for the attainment of similar ends.

"In Norway, too, and Sweden, provision has been made for the education of the artizan. Brace, in his "Norse-Folk," tells us that attached to the Latin Schools, which prepare students for the University, are, in eleven Norwegian towns, what are called real schools, from which the pupils are sent out to practical life or to the technical and military schools. In these, beside the usual instruction of the best schools, book-keeping, commercial correspondence, the properties of goods, &c., are sometimes among the branches. There are eight "Drawing Schools" in Norway. "To these, of an evening, the mechanics and labourers come together and receive instruction in modelling, drawing, mathematics and natural philosophy." The artizans of several trades are required to take out licenses, which are made dependent on the certificates of these schools. "The effect of the instruction is found to be excellent on the taste of this class in their various trades." Brace speaks of these as conferring a superiority on the Norwegian system of education over the American, to which, in other respects, it is so very much inferior. Of such schools in Sweden, coupled with a like eulogy, he says:—"In a small Swedish town, not larger than Bridgeport, for instance, you find an evening school, where mechanics can learn drawing, modelling, or the practical application of the natural sciences, without any expense. I visited one in Stockholm, which was truly a 'School of Art.' There were in it beautiful plaster models of Greek sculpture, and bas-reliefs of Italian statuary, and of the best Danish bas-relief, than which modern art has nothing more pure and classical, besides plaster casts of heads, fragments of limbs, mathematical blocks, and architectural ornaments from which to draw and model. An original device struck me here of natural forest leaves arranged to draw or mould from. All this with lessons and teachers in the arts, lectures on chemistry and the sciences, is open every evening for labouring men and women. The consequence is, as in France, you have a class in Sweden which America has not, of artizans of taste, artistic mechanics, men and women, who show ingenuity and a tasteful originality in the manufacture of furniture, the decoration, painting and preserving of rooms, the making of common wares and implements. Whatever you are obliged to buy for a house in the shops, without ordering, has not that hard, awkward, angular look, which such articles have with us. Then these schools provide women with a new and beautiful means of livelihood, the arts of designing, painting, drawing, and the applying of science to manufactures. Such schools for labourers exist all through Sweden."

"The population of Norway is about $1\frac{1}{2}$ million, and that of Sweden about $3\frac{1}{2}$ millions. In all the elements of wealth they enjoy no superiority over Canada. Their system of popular education is, as a whole, far behind ours. There is no reason why we should be behind them in this regard.

"It were a disgrace if, after taking the initiative in a scheme of improvement such as this, by the establishment of the Board of Arts and Manufactures, the Government and Parliament of the Province were to turn back from pursuing so good a work, and allow the institutions to linger in a state of inefficiency, or to perish for lack of sufficient pecuniary aid to make them really useful.

"It is hardly possible that any one can fail to see the great need of a scientific education more or less extended to all who seek to prosecute manufactures successfully. Really useful education for the several branches of manufactures must include instruction with respect to the laws of nature, and those properties of bodies which are the subject of scientific generalizations. The manufacturing system of a country should be made gradually to extend to, and to render available for use, all the vast assemblage of substances in nature which constitute its

natural resources, till all are made to add to its developed wealth. Its metals, clays, slates, marbles, granite, flint, and its other useful and precious stones; the bones, skins, tendons, horns, hoofs, and intestines of its animals; the wood, bark, roots, foliage, flowers, fruits, gums, sap, resins, and aromas of its trees and plants, all furnish matters of scientific research and industrial and skilled manipulation. The manufactories and workshops where the labouring classes are employed, are oft-times vast scientific laboratories, where industrial art is applying on a large scale to the production of the conveniences of life and of wealth, the processes discovered or improved by scientific research. Here, too, in the prosecution of his labours, the intelligent handicraftsman is day by day discovering new truths to be added to the domain of science. Heretofore philosophers have been indebted, in a rather larger degree, to the shrewd and patient observers of the workshop for the hints on which they have proceeded to the discovery of scientific truths, than manufacturers to the pains-taking researches of the experimental philosopher for improvements in processes of manufacture. It is time that the savans should repay this debt—and they are endeavouring to do so. It remained for statesmanship to furnish them the proper means and instruments, through which to confer this benefit upon the manufacturing classes and the country. The Boards of Arts and Manufactures, if furnished with means of making their organisation useful in the manner contemplated by their founders, will furnish common ground where the learned man and the practical man or worker can carry on most usefully this interchange of ideas, deriving thence mutual profit—a profit sure to benefit the country. While, on the one hand, the working man would be taught in the schools or colleges founded for him under the auspices of the Boards, the great truths of Mathematical, Physical, and Applied Science, and, it is to be hoped, the important truths of Political Economy bearing on the condition of the labouring man as well;* the man of science would have brought under his notice from day to day, in the Museum and model rooms of the Boards, the various efforts of the inventive faculties of practical men to bring into use improved mechanical appliances, and better processes of manipulation, and would be enabled to note the real progress made, and the blunders committed. While the prime object of the bounty of Parliament should be to promote the education of the industrial classes, this secondary and indirect benefit conferred upon science should neither be disregarded nor looked upon as of trifling importance.

"Doubtless, for a time at least, considerable numbers of the operative class will be unable or unwilling to avail themselves of the opportunities offered them to obtain a scientific education, or at most will only acquire an acquaintance with the merest rudimentary elements. Yet even to these, evening schools will be opened to teach them what they can and care to learn. To the more intelligent among them, and the class immediately above them, an education could and should be afforded which should be in a genuine sense scientific, and at the same time decidedly practical. That there should be a well-educated, well-informed class of men to act as foremen and superintendents of all large establishments, is almost a *sine qua non* of manufacturing success. Having to contend with the larger capital and more firmly established factories of other countries, we cannot hope to compete with them satisfactorily, if, because of our tardiness in this respect, their workmen are also much better educated, better fitted, better trained for their work. The knowledge of the best processes of manufacture, the best machinery, and the best mode of its application tends to an immense reduction of expense. Ignorance breeds waste of time, labour, and capital, which must prove fatal to success. Take but one department of skilled labour, the care of steam engines, and how frightfully long is the catalogue of known losses of life and of property resulting from the unhappy ignorance of those who have had engines confided to their charge.

"The education of the labouring man for the proper exercise of his craft is second in importance to no question of political economy or practical philanthropy which engages the attention of statesmen. And it is much to be desired that Parliament will see fit to substitute for or add to the numerous grants usually made in aid of Mechanics' Institutes, (some of which are frittered away to serve the purposes of others than the class intended to be benefitted, and others used in a manner not calculated especially to promote the education of the artizan for his business,) a large grant to the Boards of Arts and Manufactures to enable them to promote such education. Properly furnished with means and appliances for their work, they can and are prepared to perform the labour which is necessary to secure the great objects contemplated in their formation. Without those means and appliances they are powerless for good."

* What could be more important in promoting contentment and tranquility among the masses than presenting to them the golden truths comprised in a comprehensive view of the philosophy of industry, teaching them the dignity of labour; the enjoyment springing from purity of life, from well-arranged domestic economy and sanitary regulations; explaining all that relates to the enjoyment of capital, and the fair remuneration of labour; together with just views of the aims and uses of public education,—laying before them in familiar terms those practically valuable parts of political economy bearing on their local and class interests.

ATLANTIC TELEGRAPH.

The instruments on both sides of the water are now at work, and messages pass at the rate of about a word and a-half per minute.

TRADE MARKS.

A meeting of the Birmingham Chamber of Commerce was held a short time since, Mr. George Downing in the chair. The question as to the improper use of trade marks, which has been recently brought before the public in connexion with the Collins Company, U.S., against certain manufacturers in Birmingham, Sheffield, and Wolverhampton, was discussed at some length.

Mr. J. D. Goodman (Joshua Scholefield and Sons), in introducing the subject, said he was not sanguine that much good could be done by the chamber; but they should not be doing their duty by the commercial public if they flinched from considering it at a time when it had been brought so prominently before them. He was most anxious that no reference should be made to the individual cases that had recently been made public; they were not there as a court to sit in judgment, or to express opinions, or hear explanations, with respect to those cases; it was only the general ground upon which they could venture to touch upon that occasion. He thought, however, that they ought umistakeably to express their opinion that such a practice as the improper use of trade marks was wrong, and would be discouraged in every possible way by that chamber. With this view he had prepared the following proposition for their approval:—"That this chamber is anxious, in every way in its power, to discourage the improper use of trade marks, and refers the subject to the council, with a request that it may receive immediate consideration, with a view to such steps being taken as may be deemed advisable." As he had said, he did not anticipate much practical good would result, as the chamber had but little power of throwing a shield over any attempts it

might make to check the practice. Still the discussion of the question, and the publicity which might be given to it, might tend to effect their object in a great degree. The first question that arose was, "What was an improper mark?" There was no difficulty in seeing that it consisted in the use of the name of any other manufacturer residing in England or abroad; and further, all colourable imitations of such marks ought to be emphatically discountenanced. Then there was a class of marks, with regard to which there existed a misunderstanding. He referred to the names of manufacturers or firms no longer carrying on business. He believed it was a common practice to use the names of such parties, but it was quite true that in some instances the persons using them might have a property in them. Then, again, there was a great number of marks amongst which there was one kind that the chairman had spoken of. He referred to the common practice of stamping on goods the marks of the tradesmen who sold them, and not the manufacturer by whom they were made. This was a practice that ought to be deprecated in the strongest manner; but he did not see that it could be checked by any legislative enactment, nor did he think it was desirable such an attempt should be made to stop it, but were it put an end to it would redound greatly to the credit of the town, and he, for one, should be exceedingly glad to see everything that emanated from our local manufactories stamped with the word "Birmingham." At present he feared the best manufacturers in London, Sheffield, New York, and other places, were enjoying the advantage of placing their marks upon first-class goods made in this town, whilst the credit of the rubbish was left to us, though there was a good deal of credit attaching to even that. There were modifications in the use of a maker's name that were absolutely necessary. Many manufacturers stamp their name upon their best goods, their initials on the second quality, and their place of business on others. These were unobjectionable; but when they came to the use of fictitious names, which were commonly used is this town, although he deprecated the practice as not being strictly proper, it had, nevertheless, its uses. But returning to the improper use of trade marks, about which there could be no question, how could it be checked? This gave rise to another question, "Who is responsible?" As a merchant, he did not wish to flinch from a degree of responsibility in giving an order. But whilst he would hold the merchant responsible for his share he could not absolve the manufacturer from bearing his share. He was disposed almost to think that the greater share of responsibility devolved upon the manufacturers, and he would give them his reason. The merchant dealt in a vast number of articles, and he could not be supposed to have such an individual knowledge of each article as the manufacturer who made them, and therefore the latter might be presumed to be the best acquainted with the names on articles in his branch of trade, and when a manufacturer received an order to be stamped with a name which he considered doubtful, he ought to consult the merchant as to whether he had authority for using such names. The merchant when thus placed on his guard would act according to his discretion, and the responsibility would rest with him. Now, a short time ago, he heard of a merchant receiving an order for steel pens, to be marked with the name of a certain French pen manufacturer. He (Mr. Goodman) did not know the name of a single French pen manufacturer; but he thought the English manufacturer would naturally have a knowledge of such matters, and be able to inform the merchant with respect to them. On this ground it was he thought a greater share of responsibility ought to rest upon the manufacturer. If, however, both the merchant and manufacturer would do all in their power to put down the abuse of the trade marks, they should succeed at home, and by-and-by they should check the practice in other countries. No doubt at present English manufacturers were injured by the present system, and he was satisfied they had only to establish a principle in order to check it. Having observed that the Collins Company had sought and obtained legal redress in this country, and having expressed a fear that such would not be the case with an English manufacturer who might appeal to the American courts of law, Mr. Goodman remarked that he was not prepared to suggest any course that it was advisable to pursue in this matter, but he threw out the remark he had done in the hope that the chamber would be induced to assist both merchants and manufacturers in checking so injurious a system. There were many cases, in all probability, where manufacturers were using names with regard to which the chamber might entertain some doubt, and in such instances the chamber might call on them to explain the grounds on which they thought it right to use those marks, and if the chamber expressed its opinion that the marks were improper, the use of them would doubtless be discontinued.

Mr. C. Reeves seconded the proposition. He said he acquiesced in all that had been said relative to the use of illegitimate marks, and too strong language could not be used in condemnation of the practice when knowingly carried on. He did not think the checking of such practices was surmounted by such difficulty as Mr. Goodman appeared to imagine, and he considered that a legislative enactment, which should lay the responsibility on each individual concerned, would operate beneficially. He disagreed with Mr. Goodman's opinion, however, as to the amount of responsibility to be placed upon the manufacturer as compared with the merchant. How could a manufacturer, who never, perhaps, received a foreign letter, be so likely to be aware of the names of persons in business abroad as the merchant who was continually in the receipt of foreign correspondence? One great difficulty that seemed to him to be involved in the checking of the improper use of trade marks, was the objection entertained by the merchant to allow the name of the manufacturer to appear on goods exported to foreign countries. However excellent in material and workmanship goods might be, and whatever reputation a manufacturer might have, the last thing a merchant would do would be to allow him to place his name upon them if they were for exportation. He contended that the manufacturer ought to have the power of taking out a trade mark, leaving it to the merchant to accept the goods or not, as he might choose, and this would do away with the objection to the use of the manufacturer's name, whilst it would afford the manufacturers that protection to which they were entitled. He hoped ere long to see something of this kind carried into effect by law, as at present there was scarcely safety to any manufacturer using marks in cases where buyers required their names stamped on them.

Mr. J. S. Wright took a similar view of the case to Mr. Reeves, and considered the merchant ought to be made responsible in a greater degree for the use of foreign trade marks than the manufacturer, who, in may cases, might be a person that could not write his own name. He regretted that this question should have been brought under their notice in the manner it had by a recent event; but he believed much good would result from the discussion of it. With regard to this town, he thought it had suffered probably more than any other in not affixing "Birmingham" to all the goods manufactured here. There was another branch of the question in which, he thought, they ought to take action, and that was with reference to foreign made goods coming into this country bearing English names.

Mr. Reeves said that an enactment introduced some years ago into parliament by Mr. Hawkes, M.P. for Dudley, and which was still in force, would meet the class of cases referred to by Mr. Wright.

Mr. Goddard said Mr. Goodman was in error in supposing that an English manufacturer would not obtain

redress in the American law courts for an infringement of his name.

After a few words from Mr. MANTON in support of the proposition, in the course of which he said he knew many names were wrongfully made use of,

Mr. GOODMAN said he never intended to convey the impression that he thought the merchants ought not to bear their fair share of responsibility.

The CHAIRMAN, before putting the resolution to the meeting, suggested, as worthy of consideration, whether some marks analogous to the brands used in the iron trade, might not be used with advantage.

The motion was then put and carried unanimously, and the meeting was dissolved.

TUNNEL THROUGH THE ALPS.

A communication on this subject has recently been made to the French Academy of Sciences by M. Menabrea, and published in the *Comptes Rendus*, states that several months ago the immense work of boring a tunnel under the Alps, between Modane and Bardonèche, was commenced. These places are situated on opposite sides of the Alpine chain which divides Piedmont from France, at a point where the valleys of the Arc and the Doire are almost parallel to each other, and here they are on the same level, the mountain being most narrow at this spot. This important position had been noticed about twenty years ago by M. Medoil, and had often attracted the attention of engineers and geologists. The tunnel will be 12½ kilometres in length, and is designed in the same vertical plane, but, to facilitate drainage, is somewhat higher in the middle than at the extremities, so as to form a slope on each side, one being an inclination of five in a thousand, and the other being twenty-three in a thousand, in consequence of a difference of level between the two extremities, the heights being—Bardonèche (southern orifice), 1,324 metres; highest point, 1,335 metres; Modane (northern orifice), 1,190 metres above the level of the sea. The crest of the mountain being 1,600 metres higher than the highest point of the tunnel, the sinking of shafts was practically impossible; hence the tunnel could only be worked at its extremities, so that it was calculated that the labour by the ordinary processes could not be completed in less than 36 years. The difficulty of ventilation was also very great. The mountain having been examined geologically by MM. Elie de Beaumont and Angelo Sismonda, was found to contain micaceous sandstone, micaceous schists, quartzite, gypsum, and limestone; of these various kinds of rock, the quartzite alone would be likely to offer any serious resistance to engineering operations, but the stratum of this appeared not likely to be very thick. The plan proposed for overcoming the difficulties was put forward by three Sardinian engineers, MM. Sommeiller, Grattone, and Grandis, who proposed to turn the abundance of water, for which the locality was remarkable, to account by applying it to a peculiar system of perforation and ventilation. The first apparatus designed by these gentlemen consists in an hydraulic air-condenser, which is a syphon turned with its orifices upwards, and communicating by one of them with a stream of water, and by the other with a reservoir of air. The water, descending into the first branch, enters the second, and by the pressure it exercises condenses the air, which is then forced into the reservoir. When the compression of the air arrives at a certain point, a valve is opened, by which the water contained in the syphon is let out, and the operation re-commences. The emission and introduction valves are regulated by a small machine operating by means of a column of water; and the air in the reservoir is maintained at a constant degree of pressure by a column of water communicating with another reservoir above. This condensed air is used both as a motive power, and for ventilation. Commissioners were appointed by the Sardinian Government, of which the author of this paper was one, to investigate the efficacy of this plan. Their experiments were made with two kinds of perforators, worked by condensed air instead of steam, one invented by Mr. Bartlett, the other by M. Sommeiller; it is stated that by means of these, holes for blasting may be bored through the hardest sienite in one-twelfth of the time which would be required if ordinary means were employed. The perforators have also another advantage; in a space where three couples of miners could hardly be placed, 18 perforators may be set to work; so that, by these contrivances, it is said that the perforation of the tunnel may be effected in six years instead of 36, as the inventors calculate upon advancing three metres per day on each side of the mountain, or six metres per day in all. It is calculated that it will require 85,924 cubic metres of air per 24 hours to replace that which has been vitiated by respiration, torches, and gunpowder at each end of the tunnel, which is equivalent to 14,320 cubic metres of air condensed to six atmospheres. As the quantity of air necessary to put in action the perforating machines will be only 667 cubic metres at the pressure of six atmospheres, a large portion of the compressed air will thus be available for ventilation. Both on the side of Bardonèche, and on that of Modane, it is said that water power exists which is abundantly sufficient for the required purpose. Whenever this great work is finished, it is calculated that the journey from Paris to Turin will only occupy 22 hours, and from Paris to Milan only 27 hours. The author is of opinion that great credit is due to the Sardinian Government for the liberal and judicious manner in which it has encouraged this great and important work.

PAPER DUTY.

The Commissioners of Inland Revenue in their last report in reference to this subject state as follows:—

"The quantity charged with duty in the year ended 31st March 1857, 192,297,399 lbs.; in the year ended 31st March 1858, 187,414,667 lbs.

If the objections so constantly urged against the paper duty were such as we are accustomed to hear most insisted upon in the case of Excise duties generally, namely, their restricted and oppressive incidence on the manufacturer, the advocates of the abolition of the tax would find it difficult to make out their case. There is scarcely any duty in the collection of which our interference is so little felt, and in which we are so continually adapting our regulations to the wants or wishes of the trade.

An instance which has occurred this year is a fair sample of the difficulties which we have to meet, and of the disposition with which we encounter them; we allude to the drawback granted to envelope makers on their waste cuttings.

The trade of envelope making has been rapidly increasing since the introduction of the penny postage system, and has become a very considerable branch of national industry. At first it was carried on by stationers only, the papermaker being precluded by the Excise laws from engaging in it. But so long ago as in the year 1850, we were induced by the representations of the papermakers to remove the restriction, unnecessary as it was found to be for the security of the revenue, and undoubtedly interfering to a very serious degree with the natural and most economical course of manufacture. The effect, however, of this change in our regulations was something more than a mere removal of a prohibition from the papermaker to conduct his business to the greatest advantage; it gave him the means of avoiding

the payment of duty upon a considerable quantity of paper which never went into consumption, and which, therefore, according to ordinary rule, would if practicable, be fairly entitled to exemption or drawback. This was the waste produced in cutting the envelopes from the rectangular sheets of paper.

So long as the papermaker was prohibited from cutting envelopes, the duty, being charged upon the paper before it left his mill, attached to that portion which afterwards was cut away by the stationer in small angular strips—useless for any of the ordinary applications of paper; but the envelopes now allowed to be made at the paper mill are charged after being cut from the sheet, and the waste is again made into pulp and reproduced as paper.

The concession was thus of very great importance to the papermaker, and gave him the advantage over the stationer in the manufacture of envelopes, which must have been extremely valuable. It is indeed surprising that the stationers, some of whom carry on this business to an enormous extent, should not have succeeded before last year in impressing us with a sense of the injury inflicted upon them by the regulation which we had made in favour of their competitors in trade; but their case, when fully developed, was so strong, that we could not avoid making some attempt to give them relief, notwithstanding numerous practical difficulties which we foresaw. These however have been overcome, and under your Lordship's authority we are now enabled to give to stationers a drawback of the duty on the waste cuttings produced in making envelopes, on condition that such cuttings shall be reduced to pulp under the superintendence of an officer at a paper mill.

To place these two descriptions of traders on an equal footing may indeed seem too simple a matter to deserve the notice which we have taken of it. But your Lordships are aware that this concession involved great practical difficulties and some danger to the Revenue,—more, indeed, than we should have been jnstified in incurring for the sake of any less urgent claims or less important and increasing trade.

Few persons have an adequate conception of the magnitude of that trade, and few are aware that the superiority of the British over the German, French, and American manufacture has obtained for our exporters a steadily increasing business in the markets of the United States and Canada, of India, Australia, and all the British Colonies. We are entitled to regard this as some evidence that our fiscal regulations do not press unduly upon the manufacture of paper.

CONSUMPTION OF SMOKE.

Some short time since, the owners of steam-tugs plying upon the Tyne, to the number of 150, received notice from the Inspector of Nuisances of Newcastle-on-Tyne, under pain of being proceeded against for penalties under a local Act, to consume the smoke emitted by their boats, which at all times, but more especially on the occasion of busy sea tides, when from 100 to 200 vessels have to be towed out at a tide, issued from the funnels of the steam-tugs in thick volumes of the blackest density. The tug owners thereupon consulted Mr. Armstrong, of Elswick, the engineer, and, under his advice, enlisted the services of Dr. Richardson and Mr. Reed, of Newcastle, under whose superintendence experiments have for some time past been carried on, at Elswick, near Newcastle, to prove the practicability of consuming the smoke produced by the coal raised from the great coal-fields of Northumberland and Durham. It was arranged that one of the steam-tugs should be placed at the disposal of Dr. Richardson and Mr. Reed, for the purpose of making such alterations in the furnaces as they considered would effect the desired object, and in order that, in case of success, the other steam-tugs might be altered in a like manner. The *Expert* steam-tug, belonging to Mr. William Melbourn, of North Shields, was offered for the purpose, and a series of experiments were made upon the furnaces, the plan adopted being very simple, consisting of a proper admission of air into the furnace, which, combined with careful stoking, was expected to consume the smoke. After certain alterations were effected, the tug was taken to sea, with a party of steam-tug owners, and their solicitor, Mr. Kewney, and the Inspector of Nuisances on board, and it was found that the improvement effected was very great, upwards of 75 per cent. of the smoke being consumed, and the remainder being of a character far less offensive, being thin and light-coloured. The inspector considered that the result was very satisfactory. Dr. Richardson and Mr. Reed were determined, however, to effect a perfect consumption of smoke, and made further alterations. On Thursday, the 5th instant, the *Expert* proceeded to sea, on a voyage from Newcastle to Warkworth, a distance of 30 miles, having on board Mr. Miller and Mr. Taplin, Government engineers, sent from Woolwich and Portsmouth, to test the experiments going on at Elswick to consume the smoke, with a view to re-introduce the Northern coal into the naval yards; and also having on board Dr. Richardson and Mr. Reed, and a party of steam-boat owners and their solicitor. It was found that the alterations, which were of a simple character and comparatively inexpensive, entirely effected the consumption of the smoke, there being none whatever visible throughout the voyage out or home, except when Mr. Reed, in order to exemplify the truth of the system, stopped the admissson of the air, and allowed the smoke to be produced, showing at pleasure either smoke or not, as he thought fit. The other steam-tugs in the association, and the steam-ferries on the Tyne, will be fitted-up with the apparatus forthwith, and it is anticipated that a great nuisance to the river and harbour towns of the Tyne, occasioned every sea-tide by a black fall of smoke hanging over them, and sometimes entirely obscuring the view of the sea, will be entirely removed.

PATENT LAW AMENDMENT ACT, 1852.

The following is the report of the Commissioners of Patents for the year 1857, in continuance of their report of proceedings for 1856.

"The number of applications for provisional protection recorded within the year 1857, was 3,200; the number of patents passed thereon was 2,028; the number of specifications filed in pursuance thereof was 1,976; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 1,172.

The number of applications recorded within the first six months of the current year (1858) was 1,474; therefore, estimating the total number for the year at about 3,000, a decrease of about 200 on the whole year, as compared to the number of the year 1857, may be expected.

The Act 16 Vict. c. 5, enacts that all letters patent for inventions to be granted under the provisions of the Patent Law Amendment Act, 1852, shall be made subject to the condition that the same shall be void at the expiration of three years and seven years respectively from the date thereof, unless there be paid, before the expiration of the said three years and seven years respectively, the stamp duties in the schedule thereunto annexed, viz., £50 at the expiration of the third year, and £100 at the expiration of the seventh year.

One thousand nine hundred and thirty-one patents bear date between the 1st July 1854, and the 30th June 1855; the additional stamp duty of £50 has been paid on

502 of that number; and 1,429 have become void by reason of nonpayment.

All the provisional, complete, and final specifications, filed in the office upon the patents granted under the Act, have been printed and published in continuation, with lithographic outline copies of the drawings accompanying the same, and within three weeks of the respective dates of filing, according to the provisions of the Act 16 and 17 Vict. c. 115.

The provisional specifications filed in the office lapsed and forfeited, have also been printed and published in continuation.

Printed certified copies of the specifications filed in the office, as also certified copies of patents, and of the Record Book of assignments of patents and licences, with copies of such assignments and licences, have been sent, in continuation, to the office of the Director of Chancery in Edinburgh, and the Enrolment Office of the Court of Chancery in Dublin, pursuant to the Act of 1852 and the Act of 16 & 17 Vict. c. 115.

The work of printing the specifications of patents enrolled in Chancery previous to the Patent Law Amendment Act (1852), 12,977 in number, the first dating October 1711, was commenced in September 1853. This work has been completed.

In a schedule to the report is given the following account of Stamp Duties, paid upon passing Patents for Inventions under the Act to substitute Stamp Duties for Fees (16 Vict. c. 5.,) for the year 1857:—

3,200 petitions for grant of letters patent at £5 each	£16,000	0	0
2,294 notices of intention to proceed with application, at £5 each	11,470	0	0
55 notices of objection to the grant of letters patent, at £2 each	110	0	0
2,031 warrants for patents, at £5 each	10,155	0	0
2,028 patents sealed, at £5 each	10,140	0	0
1,976 specifications filed at £5 each	9,880	0	0
716 entries of assignments of patents and licences, at 5s. each	179	0	0
450 searches and inspections at 1s. each.	22	10	0
16,692 folios of office copies of documents, at 2d. per folio of ninety words	139	2	0
510 patents upon which the progressive stamp duty of £50 has been paid	25,500	0	0
1 patent on which the progressive stamp duty of £100 has been paid	100	0	0
10 patents granted under 53rd section of the Act, on which the progressive stamp duty of £16 13s. 4d. has been paid	166	13	4
5 duplicate patents issued in lieu of original patents lost or destroyed, £5 each	25	0	0
	£83,887	5	4

To the report is annexed the balance-sheet of income and expenditure for the year 1857, as follows :—

Receipts.

In stamp duties in lieu of fees	£83,887	5	4
By sale of prints of specifications, indexes, &c.	1,463	16	11
Surplus income on balance of accounts, from the 1st October, 1852, to the end of the year 1856	13,678	11	6
	£99,029	13	9

Payments.

Fees to the law officers of England	£ 8,913	9	0
Their clerks	798	10	0
Salaries of officers and clerks in the Commissioners' office	4,546	0	0
Compensations	4,584	0	0
Current and incidental expenses in the Commissioners' office	7,565	11	8
Cost of stationery supplied by Her Majesty' Stationery-office, books for the free Library established in the Patent-office, and binding	843	13	8
Rent of offices and library	490	0	0
Messrs. Eyre and Spottiswoode, for printing specifications of patents, indexes, &c., and Lithographers' bills for drawings accompanying specifications	38,506	3	2
Cost of paper supplied to printer and lithographer by Her Majesty's Stationery-office	9,161	0	6
Expenses incurred in respect of the Museum at South Kensington	1,966	0	3
Clerks' salaries for ditto	375	0	0
*Revenue stamp duty account as below	15,275	0	0
Surplus Income	6,005	5	6
	£99,029	13	9

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The twenty-eighth meeting of the British Association for the Advancement of Science will commence in Leeds on Wednesday, the 22nd of September, 1858, under the presidency of Richard Owen, Esq., M.D., D.C.L., V.P.R.S., &c.

The General Committee will meet on Wednesday, the 22nd of September, at one p.m., for the election of sectional officers, and the despatch of business usually brought before that body. On this occasion there will be presented the Report of the Council, embodying their proceedings during the past year. The general committee will meet afterwards by adjournment.

The First General Meeting will be held on Wednesday, the 22nd of September, at 8 p.m., when the President will deliver an Address; the Concluding Meeting on Wednesday, the 29th of September, at 3 p.m., when the Association will be adjourned to its next place of meeting.

At the Evening Meetings, which will take place at 8 p.m., discourses on certain branches of science will be

* The Act of 1852, in lieu of the old duties upon patents, imposed a revenue stamp duty of £5 upon the warrant of the law officer, £10 upon the certificate of payment of the progressive fee of £40 at the expiration of the third year, and £20 upon the certificate of payment of the fee of £80 at the expiration of the seventh year of the patent.

The Act of 1853 (16 Vict. c. 5.) converted all the fees imposed by the Act of 1852 into stamp duties.

The *Revenue* stamp duty account for the year 1857 is as follows :—

2,031 warrants of the law officers for patents at £5 each	£10,155	0	0
510 patents on which the progressive duty of £50 has been paid at the end of the third year from their respective dates, (£10 being *Revenue* stamp duty, and £40 fee stamp duty;) 510 at £10 each	5,100	0	0
1 Patent on which the progressive duty of £100 has been paid, £20 *Revenue* stamp duty, and £80 fee stamp duty	20	0	0
	£15,275	0	0

delivered, and opportunity will be afforded for general conversation among the members.

The Committees of Sections will meet daily, from Thursday, the 23rd, to Wednesday, the 29th of September, inclusive, at 10 a.m. precisely.

The Sections will meet daily, from Thursday, the 23rd, to Tuesday, the 28th of September, inclusive, at 11 a.m. precisely.

Notices of communications intended to be read to the Association, accompanied by a statement whether the Author will be present or not at the meeting, may be addressed to John Phillips, Esq., M.A., LL.D., F.R.S., Assistant General Secretary, Magdalen Bridge, Oxford; or to the Rev. T. Hincks, W. Sykes Ward, Esq., and Thomas Wilson, Esq., Local Secretaries, Leeds.

SOUTH KENSINGTON MUSEUM.

During the week ending 14th Aug., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,590; on Monday and Tuesday (free evenings), 4,028. On the three Students' days (admission to the public 6d.), 583; one Students' evening, Wednesday, 88. Total, 7,289.

Home Correspondence.

THE SOCIETY OF ARTS EXAMINATIONS.

Sir,—In my last letter I alluded more particularly to the mode of making Local Examinations more directly serviceable to the object in view by establishing, if possible, systematic action upon a uniform principle. I would now, however, direct the attention, not only of the Council, but also of the local authorities, to the advantage and propriety of extending the system of Examination as far as possible to the pupils of elementary classes. There is no doubt that the principal design of Mechanics' Institutions was to extend the cultivation of science and literature to those portions of the community who, from the nature of their avocations, had no other opportunity of mental improvement, but it is equally true that, from the defects of early education, which may be owing, perhaps, to early employment and parental neglect and indifference, the instruction imparted in a great many Institutions is altogether of an elementary character, whilst in many Institutions where class instruction is extensively carried on, that of an elementary character greatly preponderates. We have, therefore, to deal with a state of things which exists, if not exactly as we would have it; and the prudent course would be to render it available to the greatest extent for the promotion of that self-culture which is the distinguishing characteristic of the people of this country.

In an examination of elementary acquirements, there is, of course not required that skill in the examiners which is indispensable for the subjects comprised in the programme of the Society of Arts. Indeed, all that is requisite might be accomplished by local means, but material weight would be given to such examinations if conducted under the auspices of the Society, and certificates of a lower grade granted for proficiency. The hope of gaining a certificate would operate as a stimulus to improvement, whilst prizes, which need only be of small value, would, in many cases, be provided by those in the neighbourhood who take an interest in the welfare of the Institution, and who would have less objection to give pecuniary aid where its good effects are visible, than is too often the case at the present time, when so few comparatively seem desirous to take advantage of the opportunities afforded them. It might also be worth the consideration of Local Institutions if an incentive to elementary improvement might not be created by making membership free of payment an additional reward to the holders of first-class certificates.

All who have paid any attention to the subject must admit that no system which has yet been devised for the promotion of the instruction of the population in useful knowledge has proved so succesful as that of Examination. It is, indeed, in exact accordance with the feelings which most commonly animate human nature. Those who have mastered the drudgery of learning, and bettered their position in society, can readily appreciate the benefits of mental cultivation, but the great majority of our youth, whose subsistence depends upon their industry, whose labours of the week supply the wants of the week, are not so well able to realise to themselves the future good which they may acquire. They need some aid to lend strength to their resolves and invigorate their exertions; and, besides this, they cannot avoid the feeling that, whatever may be the amount of knowledge they may accumulate, it will prove of little value to them beyond the mere possession of it, because the humility of their position in life forbids them the opportunity of making their acquirements known to those who could render them of any value.

It is for this latter reason more especially that public examinations prove so important an aid to voluntary exertions for self-improvement, particularly with reference to the members of Mechanics' Institutions; and as those who possess the least knowledge have the least desire for the acquisition of more, the application of the stimulus to elementary instruction becomes obviously the more necessary. It may also be viewed as a preparation of students for the Examinations of a higher class, and, by rendering our young men familiar with the practice of emulation, prove of threefold benefit.

To effect this object, it will not be necessary for the Society of Arts to do more than lend its countenance to devise a uniform plan of action which shall be applicable to all Mechanics' Institutions in Union with the Society, and to grant such certificates as may be awarded by the Local Boards of Examiners appointed under their sanction. Such an addition to the labours of the Local Examiners would help to give permanence to their existence as a Board, and promote, in a great measure, that co-operation with Institutions which is so highly desirable. I would suggest that elementary examinations should be held a short time previously to the preliminary examinations for the higher branches of study, and that none but those who have shown proficiency in the first should be allowed to take part in the second. This would help to lessen the time occupied in the ordinary preliminary examinations, because the attainments of the candidates in the elementary branches of education would have been previously ascertained.

In order, however, that any benefit should arise from such incentives to education, it is indispensable that the committees of Mechanics' Institutions should use active exertions to promote the improvement of their own members. It will be a fatal mistake to rely upon the Society of Arts, or even a Local Board of Examiners, or, indeed, on any other body than themselves, if they desire to see their Institutions flourish. It is wisdom to lend aid where aid may be of service, but it is folly to allow such aid to supersede our own exertions. The great value of an Institution is in the labour devoted to the instruction of its classes within its own walls, and the value of the Examinations is in the additional stimulus which they afford to the exertions of the members, and the opportunity which they give for testing the extent of the improvement. Knowledge is but the means to an end; the certificate gained by examination is but an evidence of its acquisition, but the more substantial reward will be sure to follow, as it has followed in so many striking instances, and these facts should be steadily kept in view, both by teachers and pupils, as well as by the committees of Institutions.—I am, &c., BARNETT BLAKE.

Leeds.

Proceedings of Institutions.

Ashford.—The last report of the South Eastern Railway Mechanics' Institute states that the number of members has increased from 104 to 134. A series of monthly entertainments have been given during the winter months, consisting of lectures, essays, and readings from celebrated authors, varied with performances by the glee class. These have been remarkably successful, having been so well attended that on two occasions the room could not accommodate the number of persons desiring admission. The lectures in connection with the Institute have also been attended by a greater number of members than during any preceding season. The funds of the Institution have been augmented by a donation of £5 from the Directors of the South Eastern Railway Company, in addition to the members' subscriptions and the proceeds of the entertainments. The glee class still continues to hold its meetings weekly for the practice of glees, and a drawing class has been successfully carried on. Several additions have been made to the library.

Loughborough.—The tenth annual report of the Literary and Philosophical Society for the past year shows that it has fully maintained its position and character, both as to the interest and instructiveness of its lectures and papers and the number and attendance of its members. The committee state that it had sometimes, in years past, been a subject of regret that so few of the actual members of the society gave it the benefit of their labours in different branches of learning and science; and it was therefore with great satisfaction that they are able to state that out of thirteen gentlemen whose lectures and papers have been given during the past year, eight were members of their society. The society now consists of 162 members, 19 new members having joined, and 15 having ceased to belong to it. During the past year the following lectures and papers have been given:—Mr. J. E. Carpenter, of London, "The Road, the River, and the Rail;" Rev. T. White, M.A., "The Influence of Christianity on the Law of Nations;" Mr. Spanton, "Our Connection with the Society of Arts;" Rev. T. A. Smith, M.A., "The Study of Insects;" C. W. Wood, Esq., of Woodhouse, "The Houses we Live in," illustrated by experiments (chiefly in relation to the human body); Rev. W. Jarrom, of Kegworth, "China: its Geography, Religion, Literature, Manners, and Customs;" Prof. H. Christmas, M.A., of London, "The Domestic Habits of our Ancestors;" H. Vincent, Esq., of London, "The Progressive Tendencies of Society in Great Britain;" H. Vincent, Esq., "Our Young Men and Women; their Present Position and Future Prospects;" J. F. Hollings, Esq., of Leicester, "Russia under Catherine II.;" J. F. Hollings, Esq., Ditto, continued; Dr. Eddowes, "On Man, contrasted with the Lower Animals;" Rev. T. Drake, M.A., of Barrow, "The Mosaic Account of Creation as distinguished from Geology;" Rev. J. F. Bateman, M.A., of Sutton Bonnington, "Notes of a Visit to Canada and the Atlantic Cities of the Union;" Rev. H. G. Tomkins, B.A., of Kegworth, "Life of Alfred the Great;" Mr. H. Hughes, "The Iron Manufactures of South Wales and Staffordshire."

Newport.—The seventeenth annual report of the Athenæum and Mechanics' Institute, states that although the advance has not been so marked as in the preceding year, the Committee still think that there is reason to congratulate the members upon the present state of the Institution. The past year has been one of great commercial depression, from which the district has suffered to a very large extent. The number of members, however, has not diminished, but shows a slight increase. The Committee, having last year received notice from the Town Council to vacate the rooms so long held by them in the Town-hall, have made arrangements with the Diocesan Board of Education to take their school premises in Dock-street, for the purposes of the Athenæum, with the option of purchasing the same at the end of a year for £150. This they regard as a favourable arrangement. The building, with a small outlay, will afford a reading-room quite large enough for the purposes required, with commodious library and committee-room; and should the Athenæum increase to that extent which may be reasonably expected, there is a piece of ground large enough to erect a building, with a hall larger than any in the town. At the general meeting, held on the 27th April, 1857, the committee were recommended to appoint a paid secretary. They appointed the present secretary, Mr. Matthew Johns, and are pleased to state that they are fully satisfied with the manner in which he has performed his duties, and have re-appointed him for the ensuing year. The Committee regret that during the past year there have been no classes in existence in connection with the Institution. This they regard as a great loss to the members, and hope that in future they may be able to secure the services of a sub-committee, whose special duty shall be to look after this department of the Society's usefulness. They specially invite the attention of the members to the Examinations instituted by the Society of Arts, and while they regret that as yet there has been no offer of members to undergo such examination, they trust, for the credit of the Institution and the honour of the town, that another year will find some members ready to present themselves as candidates for examination. The average number of members for the past year has been 472 per quarter, being an increase of 16 members per quarter over the average of the preceding year. The library now contains 2,535 volumes. The committee have expended from the funds of the Institution £21 10s. 6d. in the purchase of books, and also the sum of £5, kindly placed at their disposal for that purpose by Sir Charles Morgan, Bart. Numerous donations have also been received. The number of volumes circulated during the past year has been 10,437. The catalogue has been completed, and great praise is due to the librarians for the very creditable manner in which they performed their task. The printing cost the Institution £12. The following lectures and entertainments have been given during the year:—Miss Julia St. George, "Home and Foreign Lyrics;" Sir Thomas Phillips, F.G.S., "British Rule in India;" Mr. J. T. Topham, "An Evening with Shakespeare;" Mr. J. W. R. Dickens, "Social Life in England;" Mr. F. R. Young, "Single Life;" Mr. J. E. Carpenter and the Misses Mascall, "The Road, the River, and the Rail. An Hour in Fairy Land;" Mr. J. K. Applebee, "Life's Poetry," and "Oliver Goldsmith;" Mr. Walter Rowton, "An Evening with our Comic Authors," and "Illustrations of Ancient Minstrelsy;" Rev. W. S. M. Aitchison, "Tennyson and his Poetry;" Mr. Ellis Roberts, Miss Annie Cox, and Miss B. M. Waugh, "Notes of a Wandering Minstrel;" Henry Owgan, Esq., LL.D., "The Four Literary Æras; Mr. Augustus Fairbairn and the Misses Bennett, "A Nicht wi' Burns;" Mr. C. F. Partington, "India" (two lectures); Miss Clara Seyton, "The Omnibus." The Committee have paid in fees to lecturers, and expenses connected therewith, the sum of £103 2s., the receipts having only amounted to £77 19s., thus causing a serious loss to the funds of the Institution. The average attendance was 145, which, compared with that of last year, shows a deficiency of 43 per lecture. The committee, in closing their report, desire especially to express their recognition of the services rendered to the institution by the honorary secretary, Mr. John Wood, whose persevering efforts on its behalf entitle him to the gratitude of the members. A testimonial, consisting of a valuable microscope, subscribed for by members of the Institution, was presented to him at the last annual meeting.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Aug.* 13, 1858.]

Dated 13th April, 1858.

794. G. A. H. Dean, 11, Ludgate-hill—An imp. in stereoscope's slides.

Dated 14th July, 1858.

1590. J. Rheinauer, Offenburg, Baden—Imp. in the bearings for axles and shafts, in order to lubricate and exclude dust from such bearings. (A com.)

Dated 26th July, 1858.

1683. E. Jones, Olive-house, 20, Camden-cottages, Camden-town—Effecting a better system of drainage, and the machinery and apparatus necessary for the same, whereby the sewage manure is collected and conveniently exported for use, and the noxious effluvia prevented from contaminating the air of populous cities and towns, and whereby the drains may be more strongly and securely built, by the manufacture of a more suitable and better material.
1684. H. Jackson, 130, Powis-street, Woolwich—Imp. in preparing lubricating matters.
1685. J. Hope, Rhode Island, U.S.—A new and useful mechanism or apparatus for supporting and adjusting a graver of a machine, for engraving the surface of a calico printer's roller, preparatory to the same being etched.
1686. J. Davies, Serjeant-Major, Royal Military College, Sandhurst—Imp. in cloaks for military and other purposes.
1687. P. A. Godefroy, 3, Kingsmead-cottages, New North-road, Islington—Imp. in the cleansing of gutta-percha, and in the more perfect insulation of electric telegraph wire.
1688. Henry Glover, New York, U.S.—Imp. in instruments for measuring angles and taking altitudes.

Dated 27th July, 1858.

1689. H. Ashton, Bewley street, Kirkdale—Imp. in the furnaces of steam boilers.
1690. J. Scott, Tain, N.B.—Imp. in pumps, which imps. are also applicable for the propulsion of ships, vessels, and boats.
1691. J. Emes, 110, Great Russell-street, Bloomsbury—A portable folding bedstead.
1692. T. Line, Lower Tower-street, Birmingham—Imp. in engines for raising beer and other liquids.
1694. C. N. Kottula, Liverpool—Imp. in the manufacture of soap.
1695. J. Long, Little Tower-street—Imp. in cooling brewers' and distillers' worts and other liquids.

Dated 28th July, 1858.

1698. A. Pougault, Decize (Nièvre), France—An improved apparatus for purging or clearing steam engines of their condensed water.
1700. R. Howarth, Slater Field Foundry, Bolton-le-Moors, Lancashire—Imp. in furnaces for steam boilers for the purpose of consuming smoke and economising fuel.
1702. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the preparation of hydrated oxide of chromium. (A com.)
1704. J. Taylor, J. Lang, and J. Uttley, Castle Iron Works, Stalybridge, Chester—Imp. applicable to self-acting mules for spinning and doubling.
1706. J. Miles, Risca, Monmouthshire—Imp. in annealing pots used in the manufacture of iron, steel, and other metals.
1708. W. Buckingham, Broad-street, Bloomsbury, C. Humfrey, Camberwell, and L. R. Sykes, Duke-street, Manchester-square—Imp. in the construction of telegraphic cables.

Dated 29th July, 1858.

1710. G. Cavaggia and A. Spinelli, Avignon, France—Imp. in obtaining and applying motive power.
1714. J. Brierley, Kirkheaton, Yorkshire—Imp. in machinery or apparatus for spinning wool and other fibres.

Dated 30th July, 1858.

1716. J. F. W. Featherstonhaugh, Surrey square, Newington, and F. Wise, Peckham-grove, Camberwell—An improved self acting apparatus for admitting water to steam-boilers, and indicating the water level.
1718. J. Luis, 1B, Welbeck-street, Cavendish-square—An apparatus for cooling beer and other liquids. (A com.)
1720. G. W. Reynolds, Birmingham—A new or improved cradle.
1722. J. Watkins, Newport, Monmouthshire—Imp. in machinery or apparatus for the manufacture of tallow and other candles.
1724. H. Bessemer, 4, Queen-street-place, New Cannon street—Imp. in the treatment of pit coal, and in the separation of foreign matters therefrom.
1726. J. Davey, H. Sims, J. Mayne, W. Hodge, and J. Gerrans, Gwennap, Cornwall—An improved construction of valve applicable to various descriptions of engines or machinery.
1728. N. S. Dodge, 44, St. Paul's Churchyard—Imp. in treating waste vulcanized india rubber. (A com.)

Dated 31st July, 1858.

1730. General H. Douglas, Bart., Green-street, Grosvenor-square—Imp. in freeing screw propellers from wreck or gear with which they may become entangled.
1732. W. C. S. Percy, Manchester—Imp. in arrangements and mechanism or apparatus for the manufacture of bricks, tiles, pipes, and other articles made of plastic earths.
1734. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in apparatus for planing electrotype and stereotype plates. (A com.)
1736. H. Conybeare, Abingdon-street, Westminster—Improved apparatus and machinery for the laying of submarine telegraph cables.
1738. G. T. Bousfield, Loughborough-park, Brixton—Imp. in knitting machines. (A com.)

Dated 2nd August, 1858.

1742. W. H. Crispin, Marsh Gate Lane, Stratford—Imp. in the construction of electric telegraph cables.
1744. J. W. Schlesinger, Red Grove House, South Lambeth—A new or improved machine for roasting and basting articles of food. (A com.)
1746. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of bituminous mastics. (A com.)
1748. C. Mortimer, South Carolina, U.S.—Imp. in apparatus for raising and lowering ships' boats. (A com.)
1750. J. L. Norton, Belle Sauvage-yard, Ludgate-hill—Imp. in apparatus for drying wool and other substances.
1752. H. Greaves, Westminster—Imp. in constructing streets, roads, and ways, thereby facilitating traffic and providing for the more convenient conveyance of sewage, drainage, gas and water supplies, and telegraphic wires along the same.

Dated 3rd August, 1858.

1754. W. Taylor, Titley-cottage, Kington, Herefordshire—An imp. in the manufacture of iron.
1756. T. Greenhalgh, Bury, Lancashire—Imp. in apparatus applicable to steam boilers.
1758. R. Cunningham, Paisley—Imp. in the production of letter press printing surfaces and surfaces used in reproducing ornamenting patterns or devices by printing or otherwise, and in the apparatus connected therewith.
1760. G. Bell, Fore-street—Imp. in embossing and printing dies, and in the manufacture of "lace" or perforated embossed paper.
1762. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in inkstands. (A com.)
1764. A. V. Newton, 66, Chancery-lane—Improved machinery for forging nails and other articles. (A com.)

INVENTION WITH COMPLETE SPECIFICATION FILED.

1696. G. Hurn, Norwich—Improving the manufacture of certain articles made from fibrous materials.—28th July, 1858.

WEEKLY LIST OF PATENTS SEALED.

August 14th.

161. E. Hammond.
304. W. Riddle.
306. J. Fiddington.
310. G. Claridge & R. S. Roper, F.G.S., F.C.S.
313. H. Blair.
314. F. Jones.
315. J. Beattie.
316. W. Riley.
323. J. E. Cook.
324. W. Skallitzky.
326. W. E. Nethersole.
330. H. Edwards.
333. F. M. Baudouin.
335. H. Rey-Rimels.
340. W. Betts.
344. W. Hall.
347. J. Potts.
348. F. Puls.
354. E. Toynbee.
355. G. F. White.
386. A. J. Dessales.
390. D., R., and G. Nurse.
481. G. Davies.
482. H. Dauphin.
487. G. Davies.
831. J. H. Johnson.
1042. W. C. Forster.
1076. J. Hamilton.
1109. S. Higgs, jun.
1168. P. Griffiths.
1249. A. V. Newton.
1261. T. and J. T. Crick.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

August 9th.

1800. V. Delperdange.
1809. A. Heaven.
1812. G. Durham and C. Watt.
1835. E. D. and G. Draper.
1838. A. and F. Thornton.
1864. W. and F. B. Fawcett.
1871. G. Collier.

August 10th.

1814. E. Finch.
1830. E. Topham.

August 12th.

1854. F. May.
1874. W. Sangster.

August 13th.

1841. G. Sanders and R. E. Donovan.
1848. S. Statham and W. Smith.
1850. A. V. Newton.
1861. C. Rowley.
1867. W. E. Baker.
1875. R. Crawford.
1877. A. Savage.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4111	August 7.	Improved Wet Gas Meter	W. H. Atkinson	Tynemouth.
4112	„ 18.	Safety Cab and Carriage Lamp	A. J. Clarke	Wolverhampton.
4112	„ 18.	The Atmospheric Hat	W. Gillett	Market-place, Hull.

Journal of the Society of Arts.

FRIDAY, AUGUST 27, 1858.

NEW ZEALAND.

The Society has just received from the Colonial Secretary of New Zealand a Blue Book, containing the statistics of that Colony for the years 1853-1856 inclusive :—

From these it appears that in 1856 the colony contained a European population of 48,193 souls, including 2,653 military—viz., 27,418 males and 20,775 females; the military included 2,062 males and 591 females. The population in 1855 was only 37,192, divided among the Province, excluding the military, as follows:—Auckland, 15,335; New Plymouth, 2,488; Wellington, 10,252; Nelson, 7,509; Canterbury, 6,160; Otago, 3,796. The births were 1,722 (904 of males and 818 of females); 406 deaths occurred, and 404 marriages were solemnized. Of the marriages 169 were solemnized according to the rites of the Church of England, 15 according to those of the Presbyterian kirk of Scotland, 50 according to the rites of the Roman Catholic Church, 75 according to the rites of the "free church" of Scotland; 4 Presbyterian congregations, 48 Wesleyan Methodists, 12 of "Congregational Independents," 2 of Baptists, 14 of the "Primitive Methodist Society," 4 of the Lutheran Church, and 14 by registrars. As far as it has been ascertained, it appears that of the whole population 11,309 cannot read, 6,170 can read only, and 28,061 can both read and write; the per centage of each class is respectively 24·83, 13·55, and 61·62. 326 vessels, with an aggregate tonnage of 85,748 tons, entered inwards at the several ports of New Zealand in 1856; and 323 vessels, with an aggregate tonnage of 82,991 tons, cleared out. The above is exclusive of coasting vessels. The value of the imports into the several ports was £710,868, and that of the exports £318,433. The imports into Auckland alone were of the value of £270,987, and included apparel and drapery, arms and ammunition, candles, flax, sheep, hardwares, leather, glass, agricultural implements, metals, provisions, wine, and tobacco. The principal exports from Auckland appear to be—Kauri gum (£14,000), bullion and coin (£20,000), wheat (£9,004), copper ore (£10,528), oil (£5,922), potatoes (£10,013), timber (£5,308), and wool (£6,289). The total exports of grain, flour, &c., from the colony in 1856 were in value (£28,151), Kauri gum (£18,591), oil (£10,514), potatoes (£19,958), timber (£23,008), wool £146,072) (2,559,618 lbs.) 101,596 letters were received in the colony in 1856, and 95,164 were despatched; 147,101 newspapers were received, and 124,153 sent out. The total quantity of land in culture was—in Auckland, 63,069½ acres; in New Plymouth, 9,603; in Wellington, about 15,000; in Nelson, 13,869; in Canterbury, 8,006; and in Otago, 5,022. The total revenue of the colony in 1856 was £188,328. The total convictions of Europeans in the magistrate's courts of the colony for 1856 was 2,005, of Maories 86, of which 1,151 were for drunkenness (Europeans), 38 (Maories). The mortality of the troops in the colony is 4·8 per thousand, being one-third less than in the United Kingdom, as stated in the return. 510 men were annually admitted into the hospital out of a thousand, being as stated one-half less than what occurs among infantry soldiers in the United Kingdom. Suicide appears to be more frequent than in the infantry in the United Kingdom, viz., 5 out of 10,000 in the place of two. Fevers are almost unknown, except a few bilious febrile attacks after intemperance and exposure to the heat. Smallpox has not yet appeared in the islands. Measles were introduced in 1845, and swept off 4,000 of the aborigines, the old and the young being the severest sufferers. Several cases of scarlet fever simultaneously occurred. The troops enjoy comparative immunity from pulmonary diseases, and, although influenza swept over the colony in 1853, no soldier succumbed to the epidemic. Diseases of the liver are infrequent, compared with England, and, although diseases of the digestive organs are more frequent than there, the attacks are milder. The troops continue to be singularly free from a certain class of maladies generally prevalent among soldiery. No season can be reckoned less salubrious than another in New Zealand. A series of meteorological tables are given, compiled from observations made at places in or near the coast. None have yet been made, however, in the interior, the climate of which we are as yet completely ignorant of, and it is hoped that settlers resident away from the sea coast will make meteorological observations, so that intending emigrants and others may be able to judge of the inland seasons of the country from numerical data, in place of flattering verbal descriptions.

From the data thus obtained, and other sources of information, the coast climate of New Zealand, from Stewart's Island to the North Cape, may be described as the most changeable in the world, and at the same time the most strictly temperate. For, between these two points, including a space of eight hundred miles in latitude, calms, rain, and winds, clouds and sunshine, and heat, varying between forty and seventy degrees of Fahrenheit's scale, are occasionally experienced in twenty-four hours. This singularity of the climate is probably produced by the shape and mountainous character of a great part of the country and the immense sea encircling the islands. Much importance has been attached to the mean annual temperature of countries, and New Zealand, in consequence of conclusions from this source, has been said to possess an Italian climate. But there are marked points of difference between the seasons of New Zealand and Italy. Thus, in Italy there is a sort of summer winter, when cattle must be provided for indoors as in winter, and during which for several hours of the day all out door work is interrupted by heat. There is no similar summer winter in New Zealand, and, it is the opinion of persons who have sojourned in different parts of the world that the Anglo-Saxon race can work and expose themselves to the climate of New Zealand without injury during more days in the year, and for more hours in the day, than in any other country.

With regard to the temperature, it may be inferred from the observations which have been made that the climate of the interior is warmer in summer, and colder in winter, than around the coast. These observations show that the mean annual temperature of the North Island of New Zealand is 57° Fahr., and of the Middle Island 52°. January and February, which months correspond to July and August in England, are the warmest months in New Zealand—and June and July, corresponding to December and January, are the coldest. Rome, Montpellier, and Milan, possess climates having nearly the same mean annual temperature as the North Island of New Zealand, and Jersey, one of the Channel Islands, in this respect resembles the Middle Island. The climate of London is 7° colder than the climate of the North Island, and 2° colder than the climate of the Middle Island. In New Zealand the nights are about 12° colder than the days. The mean daily range of temperature is under twenty, and the extreme range is occasionally upwards of 30°. Great variations of temperature are more common in the Middle Island than in the North. The mean temperature of places in New Zealand is lower than that experienced in corresponding latitudes in Europe, but the temperature there is higher than that experienced in corresponding

latitudes in America. It may be observed that no single locality in Europe has a temperature during the whole year like New Zealand. The North Island, in short, possesses the summer heat of Paris, Brussels, and Amsterdam, with the winter cold of Rome; while the Middle Island has a Jersey summer, and a winter in coldness resembling that of Montpellier. The difference between the mean temperature of the coldest and warmest months in the year in New Zealand is about 20 degrees: at Rome it is 27°, at Montpellier 33°, at Milan 38°, and at Jersey 22°, while New York and Quebec, placed in the same latitudes as Wellington and Otago, experience tropical heats in August and polar colds in January. Snow seldom lies on the ground at the level of the sea in the North Island, and not very often in Middle Island. But all round the year, the summit of Ruapahu, the highest mountain in the North Island, and the great mountain chains in the Middle Island, are covered with snow. Ice is occasionally seen in winter from one extremity of New Zealand to the other, but frosts are comparatively slight to the south of Auckland, although the North Cape is occasionally covered with hoar frost. An idea of the mildness of the climate at Nelson and Canterbury, in the Middle Island, may be drawn from the fact of sheep frequently lambing in midwinter with no greater loss than five or ten per cent.

With reference to the power of the solar rays, it is stated that, in the month of December, 1856, at Auckland, the sun's rays indicated a temperature of 99° Fahr. During the years 1849, 50, and 51, some observations were made on this subject at Auckland, and it was found that the mean maximum temperature of the sun's rays during the summer months was about 101° Fahr. On one cloudless calm day in February the thermometer rose to 124°, and during the same months on the banks of the Waikato river, in the interior of the North Island, to 126°. The greatest intensity of the rays occurred from noon until half-past two, when the sun was decreasing in altitude. But this stream of heat from the sun during the summer is not of daily occurrence, for even at Nelson, perhaps the most sunshiny part of New Zealand, there are about ten days in every summer month during which the sun is more or less veiled with clouds. The heat of the sun, in consequence of the winds and moisture in the atmosphere, is comparatively not much felt, and cases of Coup de soleil, a malady not unusual in New South Wales, are here extremely rare. It is probable, from the intensity of the sun's rays in sheltered spots, that grapes and other fruits ripen at places in New Zealand where the registered summer temperature is not sufficiently warm to produce such fruits.

It appears that the fall of rain in New Zealand was greatest at New Plymouth and least at Otago, and that more rain falls, and the number of rainy and showery days is greater in the North Island than in the Middle Island. Great irregularity, however, occurs all over the country in the monthly and annual quantities of rain falling in different years, but there is no doubt that most rain falls in winter. There is, in fact, no proper wet and dry season in New Zealand; fourteen days seldom pass without rain, and it rarely continues for three successive days. Heavy rains occasionally occur, although slight when compared with those experienced on the Australian continent. Upwards of 3 inches of rain fell in 24 hours at Auckland in March 1853, and 3½ inches once fell at Nelson in eight hours. The temperature of the rain is sometimes above and sometimes below that of the air. From the facts recorded, it results that more rain falls there than in London, but much less than that occurring on the west coast of England.

No observations are recorded on the moisture in the atmosphere, but, from some experiments made in 1849 and 1850, it was found that more moisture was suspended in the atmosphere at Auckland than in the atmosphere surrounding London. Persons not conversant with meteorological observations will find proofs of the presence of this moisture in the luxuriousness of the vegetation in New Zealand, the heavy night dews, and the mould which collects on unused shoes and wearing apparel. But this moisture in the climate must not be confounded with raw dampness. It produces an exquisite softness of the skin, and settlers rarely have that unpleasant glazed feeling of the skin so often experienced in dry climates. This moisture in the climate is produced by the evaporation continually going on during dry weather from the South Sea, and it is only necessary to remember that New Zealand stands in the centre of the greatest expanse of ocean in the globe to perceive the powerful influence of this cause.

In probably no country in Europe is the atmosphere so frequently agitated by winds. The mean pressure of the wind at Auckland is nearly a pound on the square foot, and the strongest wind yet registered at Auckland exerted a pressure of 35¼ lbs. on the square foot, equivalent to a velocity of 84½ miles per hour. A gale is indicated by a velocity of 50 miles an hour. The winds increase in force and frequency as we advance southwards from Auckland. Cook and Foveaux Straits are celebrated for stiff breezes and gales. At Nelson, standing at the bottom of Tasman's Bay, 14 gales, on an average, occurred annually. All round the coasts a sea breeze occasionally blows in summer.

In several places on the eastern coast, where there are mountain chains ascending about 3,000 feet above the level of the sea, a hot wind is occasionally experienced in summer. This hot wind melts the snow on the mountains of the Middle Island, swells the rivers fed from these sources, and, rushing down on the plains in different directions, according to the shape of the valleys, raises the thermometer 20° or 30°. Fortunately for vegetation this hot wind is generally the precursor of rain. On one occasion, on the Canterbury plain, a thermometer exposed to this wind rose to 113° Fahr. Different theories have been propounded as to the cause of this wind. It is probably an elevated current of the hot wind from the Australian continent, which is interrupted and directed downwards on certain places by the high mountains, while the lower current of this Australian hot wind is generally, but not always, entirely cooled by passing over the surface of the sea before reaching the western coasts of New Zealand. That this hot wind is not produced by the plains of New Zealand is almost proved by the wind being as warm at the foot of the snowy range on the Canterbury plain as at the coast. That it is derived from Australia is inferred from vessels sailing from New Zealand to Sydney having been kept back for days a long distance from the Australian coast by hot winds, and from the occasional, although rare occurrence, of a wind of about 70° being experienced at Auckland and other places on the western coast of the North Island when westerly winds with fine weather have been blowing for several successive days in summer.

According to the observations made, the air exerts a greater pressure over the North Island than the Middle Island. The influence of the wind on the atmospheric pressure has been observed all round the coasts, in one locality depressing, in another raising the barometer. The winds, unless of considerable force, are so modified by the shape of the islands that they are nothing but eddies from the greater polar and equatorial currents. Generally wind from the equator, which brings rain, depresses the thermometer, and southerly or polar winds, accompanied with fine weather, raise it. In the neighbourhood of high mountains, for example the Kaikoras, in the Middle Island, the barometer occasionally moves without an obvious atmospheric disturbance.

During eleven years there were registered at Nelson 2 solar haloes, 20 lunar haloes, 5 extraordinary tides, and 55 earthquakes. Excepting the last phenomena the above may be taken as an average for the whole of New Zealand. The earthquake region comprehends a space

of about 350 miles, or that portion of the country lying between White Island, latitude 37° 30′ and Banks Peninsula, latitude 43° 46′, having Cook's Strait for its centre. All earthquakes registered since the arrival of the settlers have been slight save those of 1848 and 1855. The atmosphere on the sea coast is not much disturbed by thunder storms, but in the neighbourhood of high mountains these phenomena are more frequent. At Nelson on an average of eleven years twelve thunder storms occurred annually, and at New Plymouth seven. Fogs are rare in the northern parts, but they increase in frequency and duration as we advance southwards. Hail storms occur. The Aurora Australis is occasionally seen from the Middle Island. Shooting stars are not so frequent as in England, and the heaven is rarely lit up with meteors of any brilliancy.

THE ATLANTIC TELEGRAPH.

The following is the report of Mr. C. T. Bright, the engineer in chief of the Atlantic Telegraph Company, in reference to the proceedings during the paying out of the cable from the *Agamemnon*:—

" *To the Directors of the Atlantic Telegraph Company.*

" Gentlemen,—On arriving at Valentia on the morning of the 5th inst., I forwarded to you by telegraph a brief report of the success which has attended the Company's endeavours to place Newfoundland in electrical communication with Ireland, and I have now the honour to lay before you fuller particulars of the operations carried out on board her Majesty's steamer *Agamemnon*, which I have been unable to do sooner, owing to the pressure consequent upon the return of the expedition.

" After our departure from Queenstown, at 2 a.m. on the 18th ult., we proceeded towards the rendezvous, which we reached on the night of the 28th, having been delayed by contrary winds and a head swell. We found the *Niagara*, *Valorous*, and *Gorgon*, which had left Queenstown on the 17th, waiting for us; and on the morning of the 29th, the sea being smooth, and the barometer standing at 30·15, the *Agamemnon* and *Niagara* were connected together by a hawser stern to stern; the end of the cable on board the latter ship was then brought by the boats of the *Valorous* to the *Agamemnon*, where the splice was finished by 1 o'clock, local time, our position then being lat. 52·8 N., long. 32·27 W., distant 938·3 statute, or 815 nautical miles from the White Strand Bay at Valentia.

" Having veered out a sufficient length to bring the splice into the centre of the curve formed by the cable hanging between the ships, the hawser was released, and we proceeded in our course slowly, paying out slack freely for the first three hours, after which the speed of the ship was increased to four, and at 7 p.m. to five knots per hour.

"All went on well until 7.45 p.m., when, immediately after passing from the outside to the centre of the coil in the main hold, the beginning of the first turn of the flake next below that in process of delivery was seen (on being exposed by the uncoiling of the cable above it) to be squeezed between the side of the cone in the eye of the coil and the end of the piece of wood by which the leading in part of the coil was defended.

" This injury occurred through the extent to which the coil was disturbed during the gales encountered in our previous voyage, and although the whole of the upper part of the coil which had been displaced to such an extent as to promise any difficulty in paying out was removed, and coiled on the upper deck abaft the fore-mast, it would appear that all the new cable which had been lately placed on the top of the main coil had shifted somewhat in the heavy weather, for it was necessary to rectify another defect, arising from the same cause at a similar part of the coil soon after.

" The old cable, which had been coiled for a longer time, and was more thickly coated with the mixture of tar and pitch, was not in the least degree disturbed.

" When the defective piece had been passed under some of the turns of the flake, then paying out to the outside, in order to allow of more narrow examination than could be made in the centre of the coil where the cable was passing out of the hold, Professor Thomson reported that continuity had ceased.

" On the cessation of signals I requested Captain Preedy to stop the ship, having placed Mr. Clifford to superintend the machine, so that as little cable might be paid out as was consistent with safety, Mr. Canning taking charge of the reinstatement of the injury, while M. Hoar attended to the dynamometer.

" It is in great measure owing to the care of these gentlemen that no ill resulted from this critical mischance.

" At 9.15 the fault was repaired, and shortly afterwards signals were again reported from the *Niagara*. We had at this time paid out 46 nautical miles of cable from the *Agamemnon*.

" The depth of water at the time of this stoppage was 2,030 fathoms, according to the nearest sounding.

" By noon on the 30th we had payed out 135·8 nautical miles, being then in lat. 52.24, long. 29.50, by observation, and 718 miles distant from Valentia, the *Niagara* having laid 130 miles of cable.

" After this the wind freshened, and a heavy swell got up, increasing the motion of the ship very much, and at midnight it was blowing hard from south-south-east, the consumption of coal required to keep up the speed which I desired to maintain being so great that some apprehension was felt in regard to the sufficiency of our supply of fuel.

" At noon on the 31st, the *Agamemnon* had payed out 280 miles, and the *Niagara* 285.

" The weather did not allow of any observation, but our run by dead reckoning made us about 605 miles from Valentia, and in the locality where the depth of 2,400 fathoms (the greatest in our route) was obtained by Captain Dayman, in Her Majesty's ship *Cyclops*, last year.

" During the day the wind continued to blow heavily, the sea running very high. By midnight the barometer had fallen to 29·50, and everything indicated a change for worse, rather than for better, weather. We had then paid out 358 miles of cable, the *Niagara* 365.

" At noon on Sunday, August 1, we were 478½ miles from Valentia, our position by observation being, lat. 52 deg. 26 min. 30 sec., long. 23 deg. 16 min. 30 sec., 434 miles having been paid out from the *Agamemnon* and 440 by the *Niagara*.

" During the morning the wind had changed to the south-west and the weather gave signs of amendment, but a heavy swell remained, and in the afternoon the breeze freshened, squalls followed each other in rapid succession, and the ship pitched as much as before.

" By noon on the 2nd we were in lat. 52.35, long. 19.48, 351·6 miles from Valentia, 605 miles of cable having been laid from the *Agamemnon* and 615 from the *Niagara*.

" In the afternoon the force of the wind decreased and the motion of the ship was much easier. At 3 p.m. we had to alter our course for a few minutes to avoid a three masted schooner, which passed us on the port bow so closely as to make it a subject for congratulation that she did not cross our path astern; the cable grew out very much to the starboard side during the change, but I caused an additional amount of slack to be paid out at the time, so that no undue strain came upon it.

" During the evening the weather was squally, and by 4 o'clock in the morning of the 3rd the wind had got round to the north-west, and a long slow swell from the south-west caused the ship to pitch and roll as much as before. At this time some excitement was created by a

bark bearing down upon our starboard beam; we increased speed to clear her, but she hove to on being intercepted by the *Valorous.*

"At noon on the 3rd we had paid out 776 miles of cable, being then in lat. 52 deg. 26 min., long. 16 deg. 7 min. 40 sec., 212·2 miles from Valentia, the *Niagara* having laid 780 miles.

"After the depth of water, which had averaged 2,000 fathoms since the 1st inst., began to lessen, and at 5 p.m. the greatest variations in our track (from 1,750 to 550 fathoms within about 10 miles) occurred; an extra per centage of slack being laid to provide for any irregularities which might there exist in the bottom. By midnight the depth had further increased to 216 fathoms.

"At 4 a.m. on the 4th the large coil in the main hold was exhausted, and we commenced paying out from the upper deck coil.

"By noon the water had deepened again to 400 fathoms; we were then in lat. 52.11, long. 12.40, only 89½ miles from Valentia, having laid 924 miles of cable, while the *Niagara* had laid 925.

"During the day the wind and sea dropped, and at 8 p.m., having reduced our distance from Valentia to 50 miles, the *Valorous* steamed ahead to make out the land.

"The water now shoaled gradually. At 8.30 p.m., having finished the second coil, a change was effected to the cable on the orlop deck.

"At midnight we were in company with the *Valorous* in sight of the Upper Skellig light, and at dawn on the morning of the 5th, abreast of the Blasquets, steaming slowly towards Valentia.

"At 6 a.m. we anchored in Doulas Bay, 2,022 nautical miles having been payed out between the two ships, and proceeded to coil a sufficient length of cable to reach the shore into one of the paddle-box boats of the *Valorous.*

"The wind freshened in the course of the morning, by which the landing of the end was somewhat delayed, the swell becoming so great that Captain Preedy got up steam in the *Agamemnon*, ready to put out to sea at any moment.

"At 3 p.m. the end of the cable was safely brought to the beach, and passed into the Company's station.

"The strain upon the cable varied during the paying-out under different circumstances of weather, depth of water, and speed of ship, as will be seen by the accompanying tabular log, which furnishes details recorded several times in each hour of the indicated strain, weight on breaks, angle of cable, rate of paying out, rate of ship, revolutions of screw, distance run according to Massey's log, distance made good by observations, and a journal of all the events worthy of note in each watch. An entry is also made of Greenwich time, so that the electrician's diary and the log kept on board the *Niagara* may be more readily compared with it.

"Some inconvenience was experienced by the great accumulation of pitch and tar, a second coating of which was laid on the cable when coiled away at Keyham for the winter, to prevent it from rusting, but this had also its advantage, in keeping down the cable leading from the coil, which had, if too dry in any place, a tendency to fly out when running at a high speed.

"The paying-out machinery (consisting of the addition of Mr. Appold's brake to one of the two machines fitted on board each ship last year, as recommended by your committee, with the dynamometer, for indicating the strain), has worked exceedingly well, in a manner which reflects the highest credit upon the manufacturers, Messrs. Easton and Amos.

"The handwheel for lifting the weights when required, designed by Mr. Amos, was of considerable service during the unfavourable weather which prevailed for the chief part of the voyage.

"The amount of slack paid out amounted to 227° upon the distance run. Less might have been laid, but I considered it desirable to insure the cable laying everywhere on the bottom—that ample slack should be used to cover any irregularities within bounds of probability.

"I must not conclude this report without again expressing my deep sense and appreciation of the laborious zeal and untiring patience exhibited by Capt. Preedy and the officers and company of the *Agamemnon;* nor can I too strongly express my obligation to Mr. Canning and Mr. Clifford, who so ably took part with me in the general superintendence of the work, and to Mr. Hoar and Mr. Moore, whose supervision of the dynamometer and machinery was of the utmost value to us; and it must not be forgotten that Capt. Hudson and the officers and crew of the *Niagara*, with Mr. Everett and Mr. Woodhouse, who had charge of the operation of paying out from the *Niagara*, with the assistance of Mr. Kell, have also performed their share of the labour equally with those who have returned to Ireland in the *Agamemnon.*

"I have the honour to remain,
"Your most obedient servant,
"CHARLES T. BRIGHT, Engineer.
"22, Old Broad-street, Aug. 19."

ARSENIC IN PAPER-HANGINGS.

In the *Journal*, Vol. V., p. 652, reference was made to the evidence of Dr. Alfred Swaine Taylor, given before a Committee of the House of Lords on the "Sale of Poisons Bill," in which he spoke of the injurious effects of paper-hangings coloured with arsenite of copper. Some of the rooms in the new offices of the Inland Revenue Department being hung with these papers, and the attention of the Commissioners having been called to the circumstance, they directed Mr. Phillips, the chemist to the Board, to investigate the subject.

The following is the report:—

"In the *Pharmaceutical Journal* for February last, page 429, it is stated that Dr. Halley, of Harley-street, had detected arsenious acid in the atmosphere of his study, the walls of which were covered with green paper, and that the test he employed was 'sheets of paper soaked in a solution of ammonia-nitrate of silver,' and that upon this paper were deposited numerous well-defined crystals of arsenious acid, visible under a low power with the microscope, and that the form of these crystals precluded the possibility of a mistake.

"Ammonia-nitrate of silver is a test of arsenious acid, but not in the manner which Dr. Halley seems to suppose, as it does not cause the deposition of crystals of arsenious acid (which are colourless), but produces a bright yellow precipitate of arsenite of silver, provided the amount of ammonia present in the test be very exactly proportioned to that of the nitrate of silver. If such be not the case, no precipitate is produced. These particulars are mentioned because Dr. Halley appears not to have resorted to any other test, but to have concluded merely from the appearance of the crystals formed on his test paper, and without analysing them, that they must be those of the poison in question.

"In the following experiments, made with a view to test Dr. Halley's conclusions, the interior surfaces of two closets were covered with green paper similar to the pattern annexed.

"Closet A had a capacity of 17 cubic feet, and was lined with about 48 square feet of the paper, or 2·8 square feet to each cubic foot of space.

"Closet B had a capacity of 26 cubic feet, and was lined with 53 square feet of paper, or 2·0 square feet to each cubic foot of space.

"These closets had no means of ventilation beyond

the chinks round the doors; the included air, therefore, would remain much longer in contact with the paper than would be the case in an ordinary room. The surface of the paper to the bulk of air enclosed was not less than fourteen times as great as it would be in a room 20 feet square and 12 feet high, thus showing that the conditions of the experiments were highly favourable to the impregnation of the air with arsenious acid, if such were possible. In each of these closets were placed two basins, one containing a solution of potash, the other ammonia-nitrate of silver, and a sheet of paper saturated with the latter reagent. Closet A was kept as much as possible from the influence of common gas. In closet B gas was allowed to burn during the day-time, the temperature of the included air being kept by the flame at from 74° to 82° F. The closets were carefully closed for 72 hours, the gas burning during that time 45 hours in closet B. The solutions of potash and ammonia nitrate of silver from each closet were then examined by Marsh's test, which is by far the most delicate known, and found to be quite free from arsenic.

"The sheets of paper saturated with ammonia-nitrate of silver were also free from arsenic, but had on their surface numerous colourless crystals which, when analysed, proved to be nitrate of silver, the evaporation of the water from the test-paper having concentrated the solution with which the paper was saturated to such an extent as to cause the nitrate of silver to crystallise out. On the test-paper was also found an amorphous substance having a dingy yellow colour, which speedily became black on exposure to light; the same substance was also observed on the surface of the ammonia-nitrate of silver contained in the basins, being most abundant in that which had remained in closet B, in which gas had been burnt. When analysed it was found to be sulphide of silver, the sulphur, no doubt, having been derived from the atmosphere of the laboratory, which always contains traces of sulphuretted hydrogen. This dingy yellow substance, which, without analysis, might be supposed by some to be arsenite of silver, was formed in a third closet, in which no arsenical compounds were present, thus proving that the green paper had no share in its production.

"The green paper used in the experiments is coloured with what is known as emerald or Schweinfurt green, which is a compound of arsenite of copper and acetate of copper. The paper contains 11·8 grains of arsenious acid to the square foot.

"The following conclusions may fairly be drawn from the experiments above described:—

"1st. That even when a small bulk of air is allowed to remain for a considerable time in contact with a large surface of the arsenical paper, and that too at a temperature of 80° F., not the slightest trace of arsenious acid is diffused in the air. Still less might the air of an ordinary room, which occupies a large space in proportion to the surface of the walls, and which is being constantly changed by ventilation, be expected to become contaminated by the poison.

"2nd. That the products of the combustion of gas do not facilitate the liberation of arsenious acid from the surface of the green paper.

"3rd. That arsenious acid is not volatilised from the surface of such paper except at temperatures too high for human endurance.

"It is probable that persons may have been affected by inhabiting rooms papered with arsenical hangings, not because the arsenious acid has been volatilised, but from the improper and frequent sweeping of the walls, by which minute particles of arsenite of copper might be detached from those portions of the surface of the paper which were not glazed, and becoming dispersed in the air, might be inhaled by persons occupying the room at the time. This only source of danger, which might be obviated by a little management in the cleaning of a room, and caution in the selection of a paper having but a little of its surface unglazed, appears not to have presented itself to the mind of Dr. Halley, who seems to have been possessed with the idea that injury to health was to be apprehended solely from the vapourisation of the arsenious acid. Dr. Taylor, on the other hand, ascribes the danger to the fact that the colour is 'put on very loosely,' and, therefore, by inference, easily detached and disseminated through the air, not as vapour of arsenious acid, but as minute particles of arsenite of copper.

"The subject under consideration being one of much importance, I have felt it necessary to enlarge upon it, and as Dr. Halley's statement is calculated to create an apprehension of danger which I believe has no existence, I beg to make the following remarks:—

"Dr. Halley states that on two occasions distinct crystals of arsenious acid were deposited on the surface of his test-paper from the air of his room. It is more than probable that if he had analysed the crystals, and not assumed their composition from their appearance under the microscope, he would have found them to be nitrate of silver. The test-paper which he used had no more effect in causing the deposition of crystals of arsenious acid than any other surface in the room would have, and to suppose that crystals of the poison were thus deposited, would be to imply that the air was impregnated with arsenious acid to an extent which must be fatal to persons inhaling it for a short time. Notwithstanding his statement that the air of his room furnished crystals of arsenious acid, he subsequently says that, at ordinary temperatures, with common atmospheric air, even when an aspirator was used, the amount of arsenic given off was 'inappreciably small,' omitting to mention what test he employed to detect a quantity not appreciable. The purport of his remarks, however, appears to be that arsenious acid, to an appreciable extent, is only given off from arsenical paper in rooms in which gas is burnt, and that the products of the combustion of the gas combine with the arsenic in the paper. If such be the case, it is difficult to conceive how the arsenious acid can be deposited from the air of the room in a free and crystalline state.

"It may be proper to mention that I and my family occupied a sitting-room three years, the walls of which were covered with paper heavily laden with arsenite of copper, and that for the same period my bed-room was also papered with arsenical hangings, yet neither I nor any member of my family experienced the slightest ill effect from such paper.

"In conclusion, I beg to express my opinion that no danger need be apprehended from a paper such as the one annexed, in which but a small proportion of the surface is unglazed, provided ordinary care be used when removing the dust from the walls, and that even if such care were not exercised, it is doubtful whether any pernicious effects would be felt by those inhabiting the room."

FRENCH WINE DISTRICTS.

The following is a summary of information collected in the principal wine-growing districts of France:—

"Alby.—The vineyards are flourishing; the oidium has caused but little injury, and an abundant vintage is expected.

"Blois.—The black grapes are beginning to ripen; the white grapes are nearly ripe; the appearance of the vineyards is perfectly satisfactory.

"Bourg.—The vineyards are in the best condition—the grapes are beginning to ripen.

"Cette.—The continued dry weather has prevented the growth of the grape, and we require great rain to repair the injury. The oidium had made its appearance, but was arrested by the sulphur applied to the vines.

"In the Gard the vineyards are magnificent, except in some elevated positions, where the grapes are suffering from the drought.

"Corrèze.—The vintage will be as early this year as in 1822. We expect to drink new wine towards the 15th September.

"Limoges.—The cold weather has retarded the growth of the grape; nevertheless we expect an abundant vintage.

"Marennes.—The vines are progressing admirably; the grapes are visibly increasing in size. There is no disease.

"Montelimart.—The appearance of a good vintage has produced a fall of 2f. the hectolitre. The price is now from 20f. to 22f. the hectolitre.

"Tarbes.—The vineyards are in the best possible condition. There will be an abundant vintage, and consequently empty casks are selling exorbitantly high."

SOUTH KENSINGTON MUSEUM.

During the week ending 21st Aug., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,025; on Monday and Tuesday (free evenings), 4,520. On the three Students' days (admission to the public 6d.), 662; one Students' evening, Wednesday, 92. Total, 8,299. From the opening of the Museum, 561,948.

Home Correspondence.

PAPER DUTY.

Sir,—The *Journal* of the 20th inst. contains an extract from the last report of the Commissioners of the Inland Revenue, which appears to me calculated seriously to mislead the reader, and I therefore ask leave to make a few remarks. The contents of the extract may be summed up in these assertions:—

1st. That the duty does not unduly restrict the manufacture or oppress the manufacturer.

2nd. That the commissioners are continually adapting their regulations to the wants and wishes of the manufacturer.

With regard to the first assertion, I affirm that the tax renders nearly twice as much capital necessary to carry on the trade of paper-making as would otherwise suffice. Let the government now lay a tax on the manufacture of iron, or on the manufacture of cotton or wool, which should render 100 per cent. more capital necessary for the same amount of production, and see what would be the result. Cotton and iron now rank first amongst our manufactures, but such an enactment would annihilate them. The rise of one-eighth of a penny per pound of cotton ruins manufacturers, and largely increases pauperism. What would a law which should practically double its price do?

But straw (of which a large amount of paper is made) is taxed 600 per cent. Is not that an undue pressure? Coloured rags are taxed 300 per cent. Is not that a restriction? In free trades if a man makes a bad debt and appeals to his creditors, they, if convinced of his honesty, generally accept a composition, but if a paper manufacturer fails to the government, they seize for twice as much as he owes; Is not that undue pressure?

The Commissioners point as a proof of their assertion to the fact of increased exports, but they do not point out the fact that we import as much paper as we export.

We fetch cotton wool from America, from India, from South and West Africa, manufacture and return it at less prices than it can be produced for in the countries where it grows; but in paper, the produce of cotton and linen waste, we are beaten by France, Prussia, and America. What possible reason is there for this result except the hindrances in the way of the manufacturer, and the fact that the simple charging and uncharging, with the separate packing necessary for export, appreciates the cost price at least 5 per cent., and is, therefore, really an export duty.

In what other staple trade can it be shown that the number of manufacturers has decreased from 30 to 40 per cent. within the last 20 years, and what but undue pressure could have brought about such a result? The assertion of the Commissioners is an apt illustration of the fisherwoman with the skinned eels; skinning does not hurt the paper-makers, they are used to it.

To the second assertion of the Commissioners, I say there is no denying that the 48 hours detention in the mill after charging is now reduced to two, and they now allow paper to be made up in parcels as well as in reams, and these are doubtless useful concessions. But if an unfortunate maker who has been all day writing the word "ream," happens to do so where he ought to write "parcel," he loses his paper. Many of the government offices use weighing machines to economise time, but the Commissioners demand the old fashioned scales and weights, thereby quadrupling the time necessary for the operation, and they are deaf to reason.

The whole number of drawbacks amount to seven, and the Commissioners take great credit for that on envelope cuttings; but they admit that the advantage of exemption was given to paper-makers in 1850, whilst the equality to stationers was only restored in October, 1857. This does not say much for the pliability of the board; especially as they have since refused a similar allowance on the cuttings from writing paper used in the manufacture of copy-books.

The mischief of the paper tax spreads itself over other trades. For instance, a large section of the markets for sewing cotton require it wound upon cards of millboard. Now such cards are produced in Prussia at less than one half of the English price, and so large is the quantity of pasteboard to cotton, that the duty on the paper appreciates the cost of the cotton by 5 per cent. The Commissioners refuse to allow a drawback on the paper thus used, and the consequence is that Manchester merchants purchase sewing cotton at Barmen, import it in *transitu* to Hull, and re-export it to South America and other ports. This is a proof of how the Commissioners adapt their regulations to the wants and wishes of the trade.

Paper as it comes from the rollers is just in a fit state to print, and the proprietor of the *Illustrated London News* proposed some time ago to take advantage of this circumstance, and to use the same steam power for printing books, and he would even have been willing to pay the tax upon the ink used, but the board refused the concession.

These are a few of the trade restrictions and oppressions, and ought to be known to all who read the report of the Inland Revenue Commissioners, but the great case for the repeal of the paper duty is the educational one. The tax on the "Irish schools lesson-books" is 12½ per cent. on the cost, "but," says Charles Knight, "the tax is doubled by the paper-maker." Now, if we assume that the paper-maker and the publisher double it between them, we are then justified in saying that for every hundred lesson books which would be printed, the Government steps in and restricts the issue to 75, thus keeping 25 children without instruction for every 75 taught. And in newspapers a great effort is at present making to universalize intelligence by means of penny papers. One of them, I am told, circulates 50,000 copies per day, and the government taxes their raw material 600 per cent., amounting to a fine of £50 per day for giving knowledge to the people. To me it seems, that if the Commissioners would only accommodate the trade by throwing their regulations in the fire and leaving manufacturers entirely alone, they would adopt the only possible mode of ceasing to restrict trade and oppress the

trader. I enclose an estimate of the probable results of the repeal of the duty. I am, &c.,

JOHN WATTS.

Whalley Range, Manchester, 21st Aug., 1858.

Probable Results of the Repeal of the Paper Duty.

The repeal of the excise upon paper would set at liberty a million of money per annum, now paid in duty, and half a million invested in paper extra, as profit on the tax. This new fund would seek productive employment in paper-making or other industry, and, if turned over twice per year, would give 20s. per week each to 57,692 workmen, who, as heads of families, would represent 230,768 individuals.

The extra production would cause extra imports, extra Customs and Excise Duties, so that the repeal would not, even in the first year, be a total loss to the government.

Here is a table of articles subject to duty, with an estimate of the consumption of one working-class family per annum, and the duties receivable thereon :—

	£	s.	d.
Corn, $4\frac{1}{2}$ qrs.	£0	4s.	6d.
Butter, $\frac{1}{2}$ cwt.	0	2	6
Sugar, $\frac{1}{2}$ cwt.	0	7	6
Molasses, $\frac{1}{2}$ cwt.	0	2	8
Tea, $6\frac{1}{2}$ lbs.	0	9	$2\frac{1}{2}$
Coffee, 13 lbs.	0	4	4
Cheese, 56 lbs.	0	1	3
Tallow, $\frac{1}{2}$ cwt.	0	0	9
Spirits, $1\frac{1}{2}$ gall. (proof)	1	2	6
Tobacco, 6 lbs.	0	18	0
Beer, 3 barrels, say	1	0	0
	£4	13	$2\frac{1}{2}$

Many articles subject to duty are here omitted, which would add to the amount; but suppose we assume the average at £4 10s. per family,—then, $57{,}692 \times 4\frac{1}{2} = £259{,}614$, which would be paid in extra Customs and Excise Duties to the Government. But manufactured produce does not find its way to the consumer at less than 33 per cent. of profit to the manufacturer, the wholesale and retail dealer.

One million and a half of money turned over twice per annum, would therefore leave about £999,999 extra subject to Income Tax, which, at 7d. in the pound, would give £29,164, which, added to the extra Customs and Excise, makes a total of £288,778. This is the probable result of the first year of repeal.

In the second year, the extra capital for productive employment would be, first, the £1,500,000 saved in the first year ; second, £999,999 profit realised thereon ; and third, £1,500,000 saved for the current year. Thus £3,999,999 would be ready for occupation, and, reckoning the extra Customs, Excise, and Income Tax upon this investment as formerly, it would be $£288{,}778 \times 2\frac{2}{3} = £770{,}074$.

In the third year, the extra capital would be, first, £3,999,999 ; second, £2,666,666 profit realised thereon ; third, £1,500,000 saved for the current year. Thus £6,166,665 would be ready for occupation, and, reckoning the extra taxation upon this as formerly, it would be $£288{,}778 \times 4\frac{1}{10} = £1{,}183{,}989$; being, in the third year, more than the sum now collected as duty on paper.

MECHANICS' INSTITUTIONS AND SECONDARY EDUCATION.

Sir,—Almost everybody thinks it desirable to continue the education of boys beyond the period at which they usually leave school. To do this there must be some strong motive to exertion, and this motive must be the prospect of some pecuniary benefit. No virtue manifests itself more strongly among the thoughtful portion of the working classes than a desire to provide against that period when they are no longer able to work. Between three and four millions of the operative classes belong to Provident Societies. Some of these societies grew out of the small provincial clubs originally established to enable the members to visit the Great Exhibition, showing that the first five shillings saved often lays the foundation of future providence and economy.

In looking over the results of the Society of Arts Examinations, I find that nearly 85 per cent. of the Candidates were under 25 years of age. Beyond this age I do not think it reasonable to expect much mental effort, except in the case of those whose minds have been early disciplined either by good teachers or good parents.

The formation of character and the general habit of mind will depend chiefly on the associations between that time when a boy leaves school, and the period when he becomes occupied with the cares and responsibilities of a family.

If anything is done for the secondary education of the working classess, it can only be done as a rule up to the age of 25 years, and by the adoption of a simple organization with a view to some practical benefit within the reach of those who choose to make the effort.

The only safe principle upon which we can act in education is to help those who are anxious to help themselves, and with this view I would suggest a system of examinations, the award of certificates, and the payment of small annual amounts on the results of those examinations. The following table will help to illustrate the idea :—

Group I.

Writing from Dictation.

	3rd class. s.	d.	2nd class. s.	d.	1st class. s.	d.
Arithmetic	2	0	4	0	6	0
English History and Grammar	2	0	4	0	6	0
Geography (Descriptive) for the 2nd and 3rd Certificates, and Physical for the 1st	2	0	4	0	6	0

Group II.

	3rd class. s.	d.	2nd class. s.	d.	1st class s.	d.
Algebra	2	6	5	0	7	6
Applied Mechanics	2	6	5	0	7	6
Geometry	2	6	5	0	7	6
Physics (Experimental).—Heat, Pneumatics, Hydrostatics, Electricity, and Magnetism	2	6	5	0	7	6
Chemistry	2	6	5	0	7	6
Drawing	2	6	5	0	7	6

The writing from dictation should be an absolute preliminary condition of examination, in any of the succeeding subjects, and the lowest or third certificates, in Group I., should be taken before any certificates were given in Group II., and these might be taken in any order convenient to the candidate, not exceeding three in one year. The only condition of examination should be a certificate from a teacher that the candidate had attended 40 hours instruction during the year in each of the subjects in which he proposed to be examined, and that he was engaged in some industrial occupation. If the principle of pecuniary aid be admitted, the rate of payment and the subjects are mere matters of detail. The money paid on these certificates should be placed to the account of the candidate in some approved Provident Society, either towards purchasing an annuity, assisting emigration, if this be thought desirable, or as a bonus at a certain period. The money should in no case be paid as a direct pecuniary reward. I think such a system of encouragement open to serious objections. The successful candidate should be encouraged to increase his certificate money by his own savings, and I believe, in many instances, the employers would give something themselves. I am not insensible to the objections which will be used against such a scheme; I have carefully considered the matter in all its details, and I shall be glad to hear an objection that can be urged against it. I give the plan publicity for the purpose of discussion, and I hope this communication will not be

passed over with the same indifference as many subjects which appear in the *Journal*.

I am, &c.,
J. C. B.

MECHANICS' INSTITUTIONS.

Sir,—The time is now approaching when, from the shortening of the days, the operations of Mechanics' Institutions should be commenced with earnestness, and it therefore behoves the respective managers to use every exertion in order to promote the due efficiency of their several Institutions, and their labours may be lightened by the conviction that judicious management at the commencement of a season spares much trouble afterwards.

Amongst the many schemes which have been devised for exciting public attention, there are few which have been so successful as a festive gathering, which, under the name of a soirée, affords an opportunity for making known the advantages of an Institution to very many who might otherwise not even be aware of its existence. If diligence be used in canvassing the locality, and any interest be taken in it by the resident gentry, there is not only the advantage of bringing all classes of the community into friendly union, but of contributing that pecuniary aid, the want of which is often so severely felt. But beyond all this the platform furnishes the opportunity of placing before a numerous audience the benefits to be obtained in a more attractive manner than could be otherwise accomplished. Prospectuses, essays, and pamphlets, may do much, but there is the difficulty of getting them read; and if this were overcome, they are by no means equal to the persuasive influence of the human voice when the hearers have come prepared to listen to the advocacy of mental cultivation for the promotion of moral and social welfare.

For full effect, however, to be given to such a demonstration, it should be followed by an active canvass of the locality, so that the most lukewarm should not have the excuse that they were never asked to contribute by a subscription to the success of the Institution. In every town there are many to be found who would not refuse to pay a small subscription, and who yet do not feel sufficient interest to take the trouble of searching out the proper officer, and tendering their assistance. The good work will also be additionally promoted by the employment of a regular collector, to be remunerated by a commission on his receipts. These, it may be said, are but helps to raise funds, but the want of funds is the paramount difficulty with the majority of Institutions, and if this difficulty were surmounted, an active committee of average intelligence would be enabled to place such attractions before the public as would materially aid in increasing their means of practical usefulness.

Another means of publicity is afforded by lectures, whether occasionally or at regular intervals. In Lancashire they profess to see no good in lectures, and pronounce them a failure; but the error often arises from expecting those delivered at Mechanics' Institutes to be of a similar kind and have the same object in view as those delivered before students in colleges. It is not practicable, nor even desirable, that systematic instruction should be given at Mechanics' Institutes by means of lectures. They should rather be of a suggestive character, pointing out the several advantages to be required by devoting the attention to the study of particular departments of science and literature, and be at the same time sufficiently attractive to secure the attendance of a numerous audience. If this be kept in view, lectures may prove a very valuable aid to most Institutions, and promote not only the pecuniary resources but the efficient working of the other departments by exciting a taste for mental cultivation.

In some Institutes a plan has been very successfully adopted of canvassing the locality to take season tickets for a specified number of lectures, and then making arrangements for the payment of lecturers according to the amount collected. It has the advantage of securing the committee against pecuniary loss, and at the same time of promoting the interests of the Institution. As to the number of lectures and rates of subscription, this is a subject which depends in a great measure upon the population, and which of course can be better judged of by each local committee. Great assistance in this department is supplied by the Yorkshire Union, who publish in their annual report a list of gentlemen willing to give gratuitous lectures, in addition to a list of paid lecturers. In the latter respect some good might be done by the Society of Arts, either through the advertising columns of their *Journal*, or by a list at stated intervals.

In my previous letters I spoke more particularly of the mode of extending the benefits of the Examinations of the Society of Arts by a systematic arrangement of Local Boards. I would now impress upon the managers of Institutes the importance of arranging by special classes for the study of the particular subjects comprised in the Society's programme, to take the initiative in inducing their members to enter into competition for the certificates, and to make the particulars known as widely as possible, so as to obtain the greatest number of candidates. If exertions be diligently used for this object, it will be found that the Examinations, by acting as an incentive to emulation, will materially promote the success of most of the Institutes that may be brought within their influence.

I am, &c.,
BARNETT BLAKE.

Leeds.

DRAINAGE BY ABSORBENT WELLS.

Sir,—The account I gave of the French absorbent wells, in 1840, and some remarks of mine on the same subject in the *Journal* of the Society, have been brought forward in support of the plan for discharging the sewage by means of such descending wells. I believe that M. Leslie will do great good by recommending absorbent wells as an occasional expedient for getting rid of impure water in the marshy and low-lying districts, but there are many objections to their application for discharging sewage matters into the sandy and gravelly substrata. The experience of Paris is opposed to it, for the well at Bondy got choked with solid matter, but there is, as I consider, the stronger reason, that to discharge manure underground would be no better than to discharge it into the sea, being only another form of wastage. There can be no doubt, as Mr. Mechi observes, that the underground strata would sooner defecate the the manure, but what we want is to accomplish the great object, long advocated by him, of saving the manure. Mr. Chadwick has shown, by the experience of Paris, that this has been accomplished to a considerable extent; and I should be sorry to be considered the advocate of any expedient which, instead of preserving fertilising materials, condemns them to destruction.

I am, &c.,
HYDE CLARKE.

42, Basinghall-street, E.C., 23rd August, 1858.

Proceedings of Institutions.

London Mechanics' Institution.—A public meeting of this Institution was held on Friday last, the 20th inst., in the theatre, Southampton-buildings, W. L. Birkbeck, Esq., president, in the chair. The object of the meeting was to receive the report of a special committee appointed in 1856 to collect funds to relieve the Institution of its building and floating debts. The following is a copy of the report:—"Your committee have to report to this meeting that they have, in pursuance of the powers

conferred upon them, collected the sum of £68 16s., and have further donations announced amounting to the sum of £47 3s., making together £115 19s. Out of the above sum of £68 16s., they have paid a sum of £10 to the Institution for a specific purpose. They have incurred expenses in making repeated applications to the government, rendered necessary by adjournments, at the latest moment, of appointments made at the treasury and elsewhere, and other preliminary proceedings, amounting to the sum of £20 1s. 4d., leaving a present balance of cash in hands of committee of £38 14s. 8d., which will appear more in detail by the cash account annexed. After mature deliberation, your committee have come to the conclusion that it is at present almost impracticable to collect a fund for the payment of the building debt of the Institution (which appeared to be the main object sought by the members in the appointment of your committee) and that the best course to adopt under the present circumstances will be to appeal to the public for funds to meet pressing emergencies, and especially for the reduction or extinction of the rent. For the sum of £3,500 the lease could be purchased, and thus the Institution could be relieved from the heavy annual payment for rent of £200. Your committee propose that an appeal be made to the public for donations to the amount of at least £1,500, leaving the remainder, if necessary, to be raised by mortgage of the lease purchased, by which means the annual rent would be materially reduced. Though your committee conceive that they have, under the terms of their appointment, the power to carry out this extended object, to remove any doubt that may exist upon the subject, it is now proposed to give them that power by a formal resolution. Several applications, both public and private, were made to the government for assistance, and some hopes were held out by Lord Granville, the then President of the Privy Council, to a deputation, consisting of members of this committee, officers and friends of the Institution, that material aid might, under certain conditions, be granted, and they were referred to the Treasury; but a dissolution of Parliament, hurried session, and change of ministry, occurring almost immediately afterwards, prevented that application from being prosecuted by the committee. The committee are of opinion that the terms upon which the subscriptions already announced have been received require that they should be returned to the subscribers who wish to withdraw them. The committee, however, believe that as a question of fact, all the subscribers are willing that their donations should be applied to the object which has been to-night announced. Your committee having now informed you of the steps they have taken, and of what they purpose doing, and having asked you for additional powers to enable them to carry their views into effect, place themselves in your hands. If you are content to express your confidence in them by granting them the further powers they ask, they are willing and anxious to unite with energy for the permanent resuscitation of this Institution; or, on the other hand, if you desire it, to resign their trust into your hands." The report was unanimously adopted by the meeting; and subscriptions were announced, in furtherance of the objects contemplated by the committee, amounting to £160. The committee was re-appointed, and the president expressed a strong conviction that its efforts would be ultimately successful. The following resolutions were carried unanimously:—"That the committee be empowered to collect subscriptions for the purchase of the lease of the Institution, and that the special committee report progress and donations received to each quarterly meeting." "That the auditors of the Institution be appointed auditors of the committee's account."

NEWPORT.—The new reading-room and library in connexion with the Athenæum and Mechanics' Institute, was opened on Wednesday, the 4th August. It is large and commodious, being 42 feet in length and 20½ feet in width, and is regularly supplied with a large number of papers and periodicals. The library contains upwards of 2,700 volumes, and additions are constantly being made. Classes for instruction and mutual improvement are intended to be formed during the ensuing quarters, and various lectures on popular, scientific, and amusing subjects will be delivered.

WINDSOR AND ETON.—A fête, in connexion with the Literary, Scientific, and Mechanics' Institution, took place at St. Leonard's, on Tuesday, the 17th instant. There was a very large gathering, although not so numerous as last year. The entertainments commenced with two cricket matches, one between members of the Windsor and Eton Institution against 11 of the Maidenhead Institute, and another between the junior members and the sons of members. There was a dinner, at which about 100 members of the Institute and their friends sat down. William Vansittart, Esq., M.P., occupied the chair. The other member of parliament for the borough, G. W. Grenfell, Esq., was unfortunately prevented from being present. In the afternoon, dancing, archery, and the Albanian minstrels were the chief attractions. The band of the Coldstream Guards was in attendance. Quoits and various other games were played. In a pecuniary point of view, it appears to be doubtful whether this fête will prove itself nearly so good as that held last year, for, although her Majesty contributed ten guineas, the Prince Consort and the Duchess of Kent each five guineas, and the members for the borough a like amount, the expenses this year have been far heavier, and the receipts from the sale of tickets considerably less. The day was observed in Windsor as a general holiday, nearly every shop was closed by one o'clock, and the bells were constantly ringing merry peals.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Aug.* 20, 1858.]

Dated 28th July, 1858.

1697. A. Kellermann, Courbevoie, departement de la Seine, France—The employ of new vegetal substances for dying, and especially to replace cochineal dye.
1699. M. Johnson, Wheelock Iron Works, Sandbach, Cheshire—An improved rotary steam engine.
1701. J. Manton, Birmingham—A new or improved candlestick.
1703. W. E. Newton, 66, Chancery-lane—Imp. in gas meters. (A com.)
1705. H. Harden, Dundalk—Imp. in the construction of tubular steam boilers.
1707. E. A. Cowper, Great George-street, Westminster—Imp. in generating power from steam, and in engines and apparatus for that purpose.
1709. J. Cliff, Imperial Potteries, Lambeth—Imp. in the manufacture of soap.

Dated 29th July, 1858.

1711. J. Musgrave, Belfast—Imp. in stalls and inclosures for horses, cows, and pigs.
1713. G. S. Parkinson, 10, Lambton-terrace, Kensington—An improved connecting apparatus for working railway breaks, and effecting a communication between railway guards and drivers.
1715. J. L. Hinks, Birmingham—Imp. in machines for cleaning knives, forks, spoons, and such other articles as are or may be cleaned by polishing, also in machines for sharpening knives.

Dated 30th July, 1858.

1717. J. Luis, 1B, Welbeck-street, Cavendish-square—A machine for cutting up almonds for the use of confectioners and others. (A com.)
1719. J. Luis, 1B, Welbeck-street, Cavendish-square—A new system of infusion apparatus. (A com.)
1721. J. Spence, Liverpool—An imp. in the manufacture of sheet, hoop, and nailrod iron.
1723. C. Schiele and F. Schiele, Oldham—Certain imp. in "hydro-extractors," or centrifugal drying machines, and in the method of lubricating their bearings, which method is also applicable to other bearings where lubrication is required.
1725. T. Webb and J. Craig, Tutbury, Derbyshire—Imp. applicable to spinning, doubling, winding, and warping yarns or threads.
1727. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in candlesticks or holders for candles. (A com.)

Dated 31st July, 1858.

1729. J. S. Bailey, Keighley, Yorkshire—Imp. in machinery for combing wool and other fibrous materials.
1731. W. Hartley, Bury—Imp. in the arrangement of slide valves and side pipes, or valve casings of steam engines.
1733. G. Ashcroft and H. Wood, Blackweir, Cardiff—An imp. in hydraulic machinery.
1735. J. Houston, Nelson-square, Blackfriars-road—Imp. in the means of effecting the consumption of smoke in furnaces.
1737. H. Conybeare, Abingdon-street—Imp. in apparatuses for generating and super-heating steam and for producing the condensation of steam.
1739. E. J. M. Cetti, Brook-street—An imp in barometers, guages, and other analogous instruments.

Dated 2nd August, 1858.

1741. E. Agneni, 29, Devonshire-street, Queen-square, Bloomsbury—Increasing particularly the effect of decorative pictures, landscapes, drawings, and prints.
1743. G. S. Hill, Ryde—Imp. in hydro-pneumatic machinery.
1745. R. R. Jackson, Blackburn—Certain imp. in machinery or apparatus for sizing yarn.
1747. S. Hine, Macclesfield—Certain imp. in machinery or apparatus for twisting, doubling, and retwisting and winding silk or other similar fibrous material.
1749. W. B. B. Harvey, Bagnal-villa, Gresham-road, Brixton—Imp. in fly or screw presses.
1751. E. Heywood, Liverpool, and W. Heywood, Manchester—Imp. in the construction of metallic pistons.
1753. M. Billing, High Holborn—Imp. in metallic bedsteads and cots.

Dated 3rd August, 1858.

1755. G. Davies, 1, Serle-street, Lincoln's inn — A process and apparatus for the extraction of oils for illuminating and lubricating purposes, and of carburetted hydrogen gas, from the native bitumen of the West Indies. (A com.)
1757. J. Shaw, Manchester—A machine for the manufacture of pasteboard and cardboard.
1759. J. Steel, Glasgow—Imp. in brewing and distilling.
1761. Lieut. J. Kingsley, 52, Great Coram-street—Imp. in the construction of steam boilers.
1763. J. Greenwood, Rawden, near Leeds—Imp. in the construction of steam boilers and other apparatus for heating water or superheating steam, which improvements are also applicable when heating air.
1765. C. De Jongh, Lautenbach, near Guebwiller, France—Imp. in machinery for assorting and preparing for spinning silk and other fibrous substances.

Dated 4th August, 1858.

1766. C. Callebaut, 2, Rue Ste. Appoline, Paris—Imp. in sewing machines.
1767. J. Spence, Liverpool—An improved method of rolling sheets from puddled steel or steel iron.
1768. J. Taylor, Birkenhead—Pneumatic and hydraulic machines.
1769. J. J. Russell, Wednesbury—Imp. in machinery for cutting and screwing the ends of tubes.
1770. J. W. Giles, Sydney, New South Wales—An imp. in propelling vessels.
1771. J. Badcock, High-street, Highgate—Imp. in apparatus to be applied to ladies' dresses and other articles of wearing apparel.
1772. W. Clay, Liverpool—An improved manufacture of metallic hoops, bands, and other analogous articles.

Dated 5th August, 1858.

1775. L. Hall, Black-lane Mill, near Bury, Lancashire—Certain imp. in looms for weaving.
1777. J. Luis, 1B, Welbeck-street, Cavendish-square—A machine for pulverising shell, horn, and whalebone. (A com.)
1779. J. Luis, 1B, Welbeck-street, Cavendish-square—A machine for drilling and grooving the naves of wheels, and also to force the axle box into the naves. (A com.)
1781. E. Leigh, Manchester—Imp. in machinery or apparatus for preparing and spinning flax, wool, silk waste, or other fibrous materials.
1783. D. McCrummen, Gourock—Imp. in the manufacture or production of paper, which improvements are also applicable in the production of alkaline and other salts.
1785. R. A. Brooman, 166, Fleet-street—Imp. in knitting frames. (A com.)
1787. W. Clay, Liverpool—Imp. in the construction of certain descriptions of bridges and girders.
1789. W. E. Newton, 66, Chancery-lane—An improved mode of ornamenting textile fabrics. (A com.)

Dated 6th August, 1858.

1791. G. H. Bovill, Durnsford-lodge, Wimbledon—Imp. in the manufacture of gas, also in the manufacture of coke and other fuel.
1793. C. F. Kirkman, Argyle-street, Regent-street—An improved mode of treating sewage of agricultural uses, and for machinery to be employed therein.

Dated 7th August, 1858.

1795. G. Watson, 6, Pond-hill, Sheffield—A washing machine.
1797. J. Walker, City-road—Imp. in the manufacture of electric telegraph cables.
1799. J. Smith, jun., Coven, near Wolverhampton—Imp. in agricultural steam engines, and locomotive steam engines to be used on common roads.
1801. J. Luis, 1B, Welbeck-street, Cavendish-square—A new covering, doubling, and twisting machine. (A com.)
1803. J. Taylor, Roupell-park, Streatham-hill, Surrey—Imp. in the manufacture of blocks for the construction of sewers and drains.
1805. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for working railway breaks. (A com.)

Dated 9th August, 1858.

1807. J. G. Picking and T. P. Purssglove, Battersea—An improved pressure gauge for steam, gas, or other fluids.
1809. T. Ingram, Bradford—Imp. in means or apparatus for operating railway breaks.
1811. W. Smith, 3, Montrose-villas, Pownall-road, Dalston—An improved compound for coating or insulating electric telegraph wires, and for coating other surfaces.
1813. A. H. Williams, Cornhill—Imp. in fastenings for portemonnaies, pocket-books, and other like articles.
1815. W. E. Newton, 66, Chancery-lane—Imp. in machinery for drawing and twisting wool, or other fibrous material. (A com.)

Dated 10th August, 1858.

1817. T. Pickford, Mark-lane—Imp. in the preparation and manufacture of manure.
1819. M. Henry, 84, Fleet-street—Imp. in the manufacture or production of saltpetre, and the preparation of materials for the purpose. (A com.)
1821. F. Haeck, Schaerbeck, near Brussels—Imp. in the construction of cocks, taps, or valves.
1823. J. H. Whitehead, Royal George Mills, Saddleworth, Yorkshire—Imp. in the manufacture of woollen bags.

Invention with Complete Specification Filed.

1856. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction of Jacquard looms. (A com.)—14th August, 1858.

WEEKLY LIST OF PATENTS SEALED.

August 20th.

360. E. Borlase.
365. J. Petrie.
371. R. F. Miller.
374. J. Arnold.
375. J. B. Barnes and J. Loach.
376. J. Templeman.
378. S. Middleton.
382. J. Morrison, senr., and J. Morrison, junr.
388. J. Knott.
446. J. H. Johnson.
458. J. W. Clare.
461. J. H. Johnson.
477. G. F. Harrington.
488. R. Roberts.
492. G. T. Bousfield.
498. M. Smith.
501. T. T. Chellingworth.
513. S. Walker.
1181. G. Cheadle.
1258. J. F. Dickson.
1312. G. Castle.
1318. T. Chatwin and C. Taylor.
1333. G. T. Bousfield.
1357. J. Rubery and T. Warwick.
1359. G. T. Bousfield.

Patents on which the Stamp Duty of £50 has been Paid.

August 16th.

1882. F. Journeaux.
2021. G. Lowry.

August 17th.

1907. V. Fouchier.
2079. W. F. Thomas.

August 18th.

1915. W. Wood.

August 21st.

1909. J. G. Martien.
1912. W. Kidman.
2013. J. G. Martien.
2082. J. G. Martien.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address
4114	August 25.	Fastening for Porte Monnaies, Pocket Books, and other Cases	C. Weintraud, jun.	Offenbach on the Maine.
4115	,, 25.	A close or open fire Kitchen Range	W. Broughton	7, South-street, Finsbury.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 3, 1858.

NOTICE TO INSTITUTIONS.

The Prizes and Certificates awarded at the Examinations held in May last, have been forwarded to the several Local Boards for distribution.

Copies of the Programme of Examinations for 1859 may be obtained on application to the Secretary of the Society of Arts.

EAST LANCASHIRE UNION OF INSTITUTIONS.

The First Report of this Union, which owes its origin to the exertions of Sir James Kay Shuttleworth, Bart., has been recently published, and as the particulars of the examination and prize scheme associated with it have already appeared in the *Journal*,* it has been thought that an outline of its proceedings will be found useful to Associations of a similar character already established, as well as suggestive to all who are interested in the progress of Institutions in various parts of the country. Local Unions of this character must always form most valuable aids to the Society of Arts, in stimulating the energies and improving the character of Mechanics' and similar Institutions, principally because their tendency has always been to give to these Institutions a really educational bearing; and ultimately it may be hoped that each Local Board of Examiners will form the centre of a "Union" of this nature.

The report commences with a short description of the district in which this Union has been established.

"The cotton manufacture has penetrated along the course of the streams which feed the Irwell and the Ribble, into valleys surrounded by moorlands, rising to one or two thousand feet above the sea, and known as the forests of Rossendale and Pendle. The streams, which caused the selection of the sites of the original manufactories, mark the lines of most easy ascent through the valleys, and determine therefore the sites not only of mills and hamlets, but the course of roads and railways.

"Since East Lancashire has been found to be rich in coal, a great impulse has been given to its trade and population. In every valley well-built villages seem strung together along the road or railroad, between which intervene hamlets, mills surrounded by groups of cottages, villas, churches, and farm-houses. This scene of enterprise and wealth extends, with little interruption, along the Irwell from Bury to the summits of Haslingden and Rossendale moors, and then descends on the other side of the watershed, through several valleys to Blackburn, Whalley, and Pendle.

"The growth of the towns, villages, and hamlets of East Lancashire has been so rapid and recent that their civilisation is in its earliest stage of energetic growth. Since 1846 considerable progress has been made in the number of elementary day-schools, and in their efficiency; even in the more considerable villages these schools are taught by certificated masters and pupil teachers.

"Not only in the towns of Blackburn, Burnley, and Accrington, but in many of the manufacturing villages of East Lancashire, evening-schools of various degrees of efficiency have followed in the wake of elementary education. These evening-schools have generally the title of Mechanics' or Literary Institutions. In almost every case a library and news-room are connected with them. They have only occasional lectures. The evening classes, before the East Lancashire Union was formed, were taught either by the master of some elementary day-school, by voluntary teachers like those which have conducted Sunday-schools, or by paid local teachers, employed as clerks or mechanics, &c., in the day time. One of these agencies often existed alone; sometimes they were combined. In two or three Institutions they all existed together.

"In some the voluntary services of professional gentlemen and of day-school teachers have been exemplary, and the prosperity, if not the existence, of certain of these Institutions, has been mainly attributable to this self-sacrificing aid. The funds of almost all the Institutions have been very slender. They were chiefly derived from the weekly or quarterly payments of the working men attending the classes, and from the profits derived from annual meetings, tea-drinkings, and to a slender degree only from local subscriptions from the middle classes. The payments of the members for the use of the library and news-room, and for admission to the evening classes, vary from 1s. 6d. to 2s. and 2s. 6d. per quarter; and from ½d. to 2d. per week, or to 1s. 6d. per quarter for the evening classes only.

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"In the village Institutions, from 20 to 70 pupils assemble on two or three nights in each week. In Burnley, the number on the books of the two Institutions is 246, and the average attendance on the classes 132. In Haslingden 115 are on the books, with an average attendance of 45.

"The great majority of the members are employed in the cotton factories, those earning their livelihood by handicraft trades not amounting to one-sixth of the factory workers. Scarcely any are employed in agriculture, and but few in shops or counting-houses. The very great majority are between the ages of 15 and 30.

"The staple subjects of instruction are reading, writing, and arithmetic, English grammar, composition, and geography, and the pupils give in nothing stronger proof of their native shrewdness than in the perseverance which they display in their preference of the classes in which these subjects are taught to merely amusing lectures, and to other studies not requiring close drudgery to master the elements. They well know that to write a good hand, to be able to spell correctly, and compose a letter of business accurately, and to be a fair accountant, are qualifications indispensable to any office of trust. These, therefore, are the objects, to accomplish which, the East Lancashire workman plods regularly twice or thrice a-week to his evening school. But it is on this basis that higher attainments also can be built, and that a wider view of the knowledge which can improve the labourer can be gained, and not a few receive a permanent impulse towards intellectual pursuits, and acquire purer tastes and a higher conception of the objects and duties of life.

"The East Lancashire Union originated in a general sympathy with these exertions of men supported by manual labour, and of their employers and friends, to supply the want of early school training, or to remedy its deficiencies. It was known that the attendance on the evening classes fluctuated,—being in some years double or treble that of others. Generally in the summer the number of members did not exceed one-half or two-thirds that of the winter. In the autumn the classes often dispersed. Some village Institutions had a feeble life, with a meagre apparatus of instruction, few members, and intervals in which their proceedings were entirely suspended.

"To strengthen the managing committees by that encouragement which arises from co-operation, it was thought desirable that the Institutions of East Lancashire should be organised into one Union, in which each should be represented in a council. The fluctua-

* See present Vol., p. 329.

tions of attendance, and the want of perseverance in a course of self-culture, pursued from year to year, might, it was hoped, be diminished by a system of examination and prizes, which would not only reward by an immediate distinction the exertions of the candidates, but encourage them by the hope that the employers of labour throughout the district would recognise the value of such pursuits, by selecting for employment and promotion not only the successful candidates for prizes, but the most zealous and persevering members of the evening classes.

"The scheme of examination was so framed as to give prominence to those rudimentary English exercises which are the instruments by which other knowledge is gained, and then to lead the humble student to acquirements which would expand his intelligence, rather than to a narrow and eager devotion to a single subject. The object sought was a sound knowledge of the elements of an English education, solid in each part, but not restricted to one separate technicality. On this firm basis those gifted with greater power, or favoured by more ample leisure, were encouraged to build a somewhat larger structure of learning appropriate to their station in life. By this means, it was hoped, that the subjects taught in each institution would be gradually matured in proportion as its resources in teachers, books, and apparatus grew.

"To increase the strength of these agencies a fund was collected, toward which liberal annual contributions were made by the principal landed proprietors of East Lancashire, and by some of the chief manufacturers. This fund provided, in the first place, for the working of the examination and prize scheme.

"A persevering effort was then made to introduce into the Union a higher class of masters, who should visit each institution on appointed evenings, to organise and teach the classes; to give brief collective lessons on such subjects as physical geography and history, &c., and to deliver courses of Saturday evening lectures.

"A weekly visit of the organising master, besides the immediate benefit to be derived from his systematic and skilful instruction, was intended to prove a stimulus to the exertions of the teachers and visitors. It was expected that he would increase the interest of the working men in the evening school; that he would promote the better furnishing of the class-rooms, and organization of the classes; the purchase of books, maps, and apparatus, and the growth of a stronger local interest in the well-being of each institution.

"The organizing masters selected had passed through the entire career of education from apprenticeship as pupil teachers; had gained Queen's Scholarships, and obtained three years' education in a training college, followed by the subsequent experience of two years as teachers of physical science in their college.

"The masters so qualified were allowed salaries of £100 per annum, and their travelling expenses on a moderate scale, in addition to the augmentation paid to them by the Committee of Council on Education. They were expected to teach on five evenings in each week, for two or three hours, the classes of separate Institutions, and each Saturday evening to deliver one of a course of four lectures. This course was to be devoted to some subject of immediate sanitary or commercial importance, and was to be delivered successively at each Institution throughout the Union. The organising masters were allowed four hours daily to derive remuneration from other professional pursuits, consistent with their engagements in the Union and their obligations to the Committee of Council.

"Each Institution which has the advantage of the instruction of the organising master in teaching its classes on one evening weekly, pays to the funds of the Union £15, and for two evenings weekly, £30.*

* For instructions to Organising Masters, see page 617.

"Several of the Institutions thus visited by the organising master have a fresh supply of books; some have improved their class furniture; almost all have increased the number of their members and of their candidates for prizes, and in all the greater efficiency of the instruction has increased the local interest in the Institution. The Saturday evening lectures have been steadily attended; they have been illustrated by appropriate experiments, and by diagrams and apparatus which have been purchased for this purpose.

"The Education Department of the Privy Council has also admitted the Council of the Union to participate in the same class of advantages from their grants as the committees of day schools are allowed to claim for their evening schools. This rule enables the Council to procure for each Institution the aid of an assistant or local teacher, towards whose stipend the Committee of Council pay £10.

"This local teacher is commonly some artisan or clerk who has been educated in the Sunday, day, and evening schools, and by persevering self-culture has acquired a competent knowledge of the subjects of elementary instruction. The conditions of his appointment are, that he pass an examination before H.M. Inspector of Schools; that a sum equal to that paid by the Committee of Council on Education be derived from the school fees paid by the members to the funds of the evening school, and that the evening class be found in a satisfactory condition on inspection.

"The efforts of the local teachers for self-improvement may be greatly aided by the organising masters. They may guide the reading of the local teachers,—initiate them into improved methods of instruction, both by example and private suggestion, and thus prepare them to avail themselves of the minute of the Committee of Council, by which, after one year's service, they may gain a Queen's Scholarship and enter a training college, or after three years' service, may present themselves for examination for a certificate of merit. The local teachers hold the same relations in these respects to the organising masters as assistant teachers to the masters of day-schools.

"It would also always be well that in every Institution in the Union one or more candidates for the office of local teacher should be in training under the superintendence of the organising master, so as to be ready for examination when any vacancy occurs.

"The examination and prize scheme for 1856-7 proved throughout the Union a useful stimulus to the members of the evening classes. Their attendance became more regular, their members increased, and their zeal in their studies was more marked and constant. The Committee of each Institution also showed a growing interest in the success of their candidates, and in the development of the means likely to promote this result.

"This stimulus has also in some Institutions extended to the valuable exertions of the gratuitous teachers. These important services have been rendered with great zeal and self-denial in several of the Institutions. Some of the most important evening schools in Manchester are mainly dependent on the voluntary agency of the same kind that supports Sunday-schools. In others, skilful teachers, and professional men, clergymen, and others devote themselves to this work. Too much praise can scarcely be given for the admirable examples of such labours which exist in the Union."

The report then goes on to say that in August, 1857, twenty candidates were examined, some of whom were successful in obtaining prizes.

"The examination and prize scheme for 1858 was founded on the experience thus acquired. Besides many modifications in detail, it called the attention of the Committees of Institutions throughout the Union to the organization of female classes. Subsequently a circular was issued by the Council, to diffuse among the local committees a knowledge of the expedients which had

been most successful in the founding and working of female classes."

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"During the winter of 1857-8 exertions were made to found a School of Art in Burnley, in connection with which it was hoped that branch schools might be formed in other parts of the Union. In Burnley the School of Art opened in April with 730 pupils in elementary day-schools; a class of 90 teachers and pupil teachers; a class in each of the two Institutions for artisans, attended by 34 together; a class of 17 in the Grammar-school, and a ladies' class of 20 members. A supply of models and apparatus was obtained, at reduced prices, from the Department of Science and Art. The department also selected from among its certificated students, Mr. Gunn to take charge of the drawing classes, under the direction of a local Art Committee. When these steps had been taken, the School of Art was recognised by the Council of the East Lancashire Union as a part of its organisation, and the committees of certain neighbouring Institutions were invited to consider the arrangements necessary for the formation of other local schools. The negociations for this purpose are still in progress. Whenever a class can be formed for ladies or gentlemen, of twenty or thirty members, the art master will be enabled to undertake, for the same low rate of remuneration as at Burnley, the instruction of classes of artisans, and teachers and pupil teachers. Artisans who are members of Institutions pay 1s. 6d. per quarter; those who are not members, 2s. 6d.; and tradesmen, 2s. per month, with 2s. entrance fee. Teachers pay 10s. per annum, and pupil teachers 2s. 6d.

"The ladies' and gentlemen's class, according to the distance travelled by the master, pays from 20s. to 40s. for one hour weekly, and from 30s. to 60s. for two hours weekly.

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"Thus far is recorded the experience of the Council in their efforts to promote the prosperity of the Institutions of the East Lancashire Union by a common organisation. If this Report should encourage the formation of similar Unions in other districts, perhaps advantage would be derived from a statement of some conclusions derived from this experience.

"The East Lancashire Union is comprised in a circle, the longest radius of which does not exceed ten miles; and from Burnley and Accrington railways branch in three directions. They penetrate also the valleys of Rossendale. The organising masters, therefore, visit the evening schools to teach and lecture at small expense of time and money.

"Even with these facilities of intercourse, the Council are of opinion that the Union could not be extended beyond this circle, without losing that compact corporate character which seems essential for its success. Some of the members of the several committees are known to each other. The state of each town and hamlet is understood. The occupations of the members of the evening classes and of their directors in each institution resemble those of others. There is that bond of neighbourhood which produces a compact structure capable of harmonious action. This corporate life would become languid, or wanting in harmony, if the Union were more extensive.

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"The importance of the Institutions by which the education of the workman is carried forward from the ordinary school-age to manhood, and the need of some organisation to give them a more energetic life, is daily becoming more apparent. The Government and the religious communions now expend annually on day and Sunday-schools, including the school-pence paid by the scholars and the cost of the evening-schools, a sum certainly not much less than two millions. In the cotton districts the schooling of a child ceases at thirteen, and he keeps half-time at work and school from eight to thirteen. In the agricultural districts he leaves school at ten, or eleven, or earlier. Even in schools conducted by certificated teachers, aided by pupil teachers, with every appliance of instruction, the schooling thus obtained cannot be expected generally to form habits of self-culture, such as would induce or enable the child taxed with daily labour, when the day-school is left, unaided by the evening-school, and tempted by rude, if not coarse forms of recreation, to improve the little learning he had gained. Too often this slender stock dwindles year by year with neglect, until even his poor skill in reading, writing, and counting becomes more and more imperfect. Then come the temptations of youth, and at the time when mind and the senses strive for mastery, unless the young man finds which is the nobler part of his nature by its cultivation, he is bewildered by passion and degraded into sensuality. In this strife the little learned at school is lost, and the man at twenty probably cannot sign his name to the register of his marriage. Should such a result be general, the nation is expending two millions annually to purchase what is too meagre and transient. If attendance on the day-school cease at ten and thirteen, and its influence be lost in the turbulent effervescence of youth, such a fact once established, and nothing done to remedy the evil, the promoters of elementary schools would lose at least the earnestness of their faith in the regenerating influences of education on the character and destiny of the humbler classes. Neither the zeal of the religious communions, nor the political foresight of the Government could be appealed to for so large an annual outlay, unless each successive generation brought up at school became less sensual and more intelligent.

"The waste of costly effort occurs not in the school, but in the time between the school-age and manhood. Habits of self-culture can alone prevent this waste, by improving what it has cost two millions of annual outlay to create. These habits, according to our experience, are seldom formed without aid. That assistance may perhaps be effectually rendered if evening-schools be universally founded, and so efficiently conducted as, with every proper incentive, to attract to them the youthful population between the school-age and manhood. In this view the evening-school becomes an institution as indispensable as the day-school to those influences of education on the character of the population, for the hope of which we now pay so large a sum without attaining the result which we seek. Every expedient, therefore, which can promote the increase and ensure the efficiency of evening-schools, must be important as part of the machinery of national education.

"To attract the working men to these schools, no local expedient would be so efficient as that the employers of labour should invariably inquire of every candidate for employment as to the whole course of his education. If parents and our youth knew that the master always ascertained and recorded how many years had been spent at the day and Sunday-school—how long and with what degree of regularity the evening-school had been frequented—whether a prize or certificate had been obtained—whether the youth had been employed as a Sunday-school teacher, or local teacher of an evening-school—then they would know that early education and subsequent self-culture were sources of confidence and respect leading to offices of trust.

"A sense of the value of education on this lower ground must probably precede the higher conviction of its importance as a means of self-discipline. This is a better state of mind which seeks to perform the duties of the sphere in which we are born, perfectly in the sight of God and man, with calm contentment in our lot, than that which only strives to rise in life without reflecting on the more weighty responsibilities of that higher condition. This better state of thought will in time visit

many minds who, in the fervid time of life, first strive to rise above the condition of manual labour. Those who seek to better their material condition may attain a vastly greater gain, though they remain dependent on daily labour. It is therefore pleasant to record, that at the formation of the Union a majority of the principal manufacturing firms signed a declaration* that they would attach great value to the certificates awarded by the Council. The Council also have learned, with much satisfaction, that the prizes and certificates gained at their first examination have, in some instances, been followed by promotion to offices of trust, and in many have been otherwise advantageous to the successful candidate."

The Report then proceeds to draw attention to the great public advantage that would arise if the primary nominations to the whole of the smaller offices of the Excise, Customs, Inland Revenue, and Post-office, were limited to those who distinguished themselves at Examinations of this character. It appears that the number of the subordinate offices for which the scholars of elementary day-schools might, if they retained habits of self-culture through youth to manhood, fit themselves at ages varying from 17 to 23, has been carefully ascertained by Mr. Horace Mann, the Assistant Secretary to the Civil Service Commission. There are 12,618 offices worth £50 to £80 per annum in the Excise, Customs, and Post-office, affording from 700 to 800 annual vacancies. Also 3,840 clerkships exist in the Customs, Inland Revenue, and Post-office, with about 300 vacancies annually, and a further prospect of promotion to offices of from £300 to £600 per annum.

"The preceding considerations apply equally to the great mass of the working population of Great Britain, and with peculiar force to those portions of it which, like the inhabitants of East Lancashire, are distinguished by a hardihood and skill in all forms of manual labour,—by an energy and enterprise which so frequently raises the workman to the rank of employer, and by an intelligence which has enriched with subtle inventions those combinations of the physical powers by which the Cotton Trade has triumphed over all competition. Amongst this noble race of men, there are also rarely-gifted minds, who, untrained even by the humblest elementary schooling, have battled manfully with their fate, and step by step emerged from the slough of ignorance and brutishness. They have learned to read on scraps of newspapers and pamphlets from whomsoever they could snatch a moment's sympathy and help. They have learned to write by painful efforts at imitation, whenever they could get anything to copy; in like manner to cypher. They have found some elementary work on mechanics, mathematics, or chemistry at a book-stall, and mastered everything in it. Without a teacher, without a guide, —led by those events which we call accidents, to the pursuit natural to their genius, such men have sometimes become the architects of the fortunes of our chief families. There are such men living and amongst us now, and from their own lips we learn how eagerly they would have embraced opportunities of self-culture like those offered in the Evening Classes of the East Lancashire Union; and how many victims, not so aided, have not had physical strength to endure the arduous struggle of daily toil and midnight sweat of the brain, but have perished unrewarded and unknown.

"There is another class of self-educated working-men, of a gentler and more retiring character, and less vigorous enterprize;—the self-educated students of nature; the self-taught botanists, entomologists, and geologists, who, working at a handicraft which leaves them some hardly-earned leisure, devote it with a calm but enduring enthusiasm to read that page of the Will of God which is open to every inquirer. Mr. Binney, of Manchester, has watched with deep interest the lives of many such men. Their biographies have been briefly recorded from time to time in the county papers by faithful and sympathising friends. Some of them are personally known to members of this Council, who can testify, from intimate association with them, how much such pursuits refine, elevate, and purify. Even a scholar-like demeanour distinguishes some of this class of humble naturalists, who have a store of information from sedulous reading out of their peculiar range. Their calm pursuits make them content with their lot.

"The East Lancashire Union will not fulfil the intentions of its promoters unless it offer facilities for study, opportunities of meeting, and other forms of encouragement to the self-taught naturalists of the district. Its present classes afford means of mastering the elements to all, and men of genius will, with the aid of organising masters, libraries, apparatus, and lecturers, be enabled, with abundant sympathy, to tread the upward path of science and literature.

"Such opportunities for men of humble station and great ability were formerly afforded by the bursaries and exhibitions of our endowed schools, which launched them on a career of university education. The Queen's Scholarships, which open a path to the Training Colleges for the local teachers of evening-schools, partake of the character of these ancient endowments in their intention to reward such intellectual merit by means of further instruction.

"The Union is likely to develop among all actively engaged in working out its design a lively interest in the progressive education of the youth of the district from 13 to 30, and in the destiny of every earnest and gifted man who avails himself of the opportunities which it offers, and earns the distinctions by which his merit may be made conspicuous.

"The Council turn from the aid which the Union can give to such rare and gifted men to the opposite extreme. They may be asked what hope they have that these evening-schools can change the habits of the most sensual and ignorant portions of the population, who at present scarcely enter their classes. They point, in reply, to some indications of the gradual progress of civilization, resulting perhaps from a general improvement in the manners of all classes—from the influence of Sunday-schools in the early part of this century; and from that of the press, and of public opinion. The day-schools are of too recent origin to have produced much effect.

"The still prevalent gambling and pigeon-flying have taken the place of even the more cruel and coarse man-fights, bear and bull-baiting, and dog and cock-fighting, which within a generation were sanctioned by the patronage and presence of the gentry. Let us hope that the cultivation of cottage gardens, the cricket club, and the manly game of football,—the public swimming bath and gymnastic exercises,—the chess club, the newsroom, the library, the evening classes and the lectures of the Institution, will take the place of the coarse and absurd pastimes of the lowest part of the population. The instrumental bands, choral societies, and glee clubs which exist, are not abused by intemperance, but form a recreation deserving encouragement. Of late years the cheap railway excursions to the coast, or to remarkable inland scenes,—the taste for public meetings, assemblages for charitable or other social objects, and for discussions on political and religious questions, more and more engage the attention of the mass. During the recent wars the papers have been eagerly read to groups of attentive listeners in workmen's houses. The civilisation thus spreading has been found to be attended with an increasing aversion from all forms of popular error on social questions, with greater security for property, and a firmer confidence in the Institutions of the country. It is the earnest wish and conviction of the Council, that it may co-operate with our common faith in creating a people contented, loyal, and religious."

* This declaration is of a similar character to that issued by the Society of Arts. See *Journal*, Vol. IV., p. 587.

The following circular, as to the duties of organising masters and local teachers, and the conditions on which each Institution in the Union may obtain this aid, was issued to the Institutions:—

"Burnley, November 18th, 1857.

"SIR,—At the request of the Council of the East Lancashire Union of Mechanics' and other Institutions, I convey to your Committee of Managers information of the arrangements which they will have to make in order to avail themselves of the assistance placed by the Committee of Council on Education at the disposal of the Council of the Union.

"This assistance is in two forms, viz., first, local teachers; secondly, organising masters.

"The local teacher is intended to be selected from the class of young men employed in some other vocation during the day, who are competent at least to teach reading, writing, arithmetic, and English grammar, or geography, or English history. A certificate of character and of their aptitude to teach must be sent to the Council of the Union. If nominated by the Council, they will be examined as soon as convenient by Her Majesty's Inspector in the foregoing subjects; but he will report specially in favour of such of them as have any knowledge of land or mine surveying, of mechanics, of the steam-engine, of map and plan drawing, or of chemistry. Such a special report would greatly facilitate the future promotion of the local teachers to Queen's scholarships or certificates of merit, though not required for their present appointment. Local teachers must be at least 20 years of age, and under 40, at the time of their appointment. When the evening-school consists of males and females in the same room, the local teacher must be a married man; where it is attended by females only, a female; and where by males only, a male.

"Where there are separate male and female classes, it is probable that the Committee of Council might be induced (by a favourable report from Her Majesty's Inspector, as to the qualifications of the candidates for the office of local teacher, and as to the numbers attending the classes, and their state of efficiency) to sanction the appointment of both a male and female local teacher in one Institution. Any local teacher thus nominated to an evening-school by the Council of the Union, and sanctioned by Her Majesty's Inspector, having served therein to the satisfaction of the Committee of Council on Education, upon the report of Her Majesty's Inspector, for one year, may attend the examination (Minute 20th August, 1853, s. 13) for registration, and on passing it, will be allowed a Queen's scholarship of £20 or £25 to any training school under inspection (with the consent of its managers) he may select; the amount of the scholarship to depend on his passing to the extent required under the minute of 2nd April, 1853 (Capitation), or to the extent required for pupil-teachers.

"Any local teacher nominated and approved as above to an evening-school in the Union, after three years' service under inspection to the satisfaction of the Committee of Council on Education, and being upwards of 30 years of age, may be examined for a certificate of merit; such certificate not bearing any pecuniary value until the holder be in charge of an elementary day school fulfilling the usual conditions required for the augmentation of the salary of the teacher by Government.

"The appointment of local teacher thus opens a path in which any person in the Union now, too old to become a pupil-teacher, may gain a Queen's scholarship, may have the advantage of education in a training-school, and may enter on the career of the teacher of an elementary day-school, with a certificate of merit and augmentation of his salary by the Government. His prospects of promotion will be greatly increased if the managers can secure a visit from Her Majesty's Inspector, and if he find the evening classes in an efficient state and the attainments of the local teacher satisfactory. Though the evening classes will be liable to such inspection, it is to be feared that the very numerous engagements of the Inspectors will prevent their visits unless urgent solicitations be made.

"Such advantages will, it is hoped, greatly facilitate the selection of thoroughly-qualified teachers by the managers of the several Institutions and evening classes in Union.

"The Committee of Council will pay £10 annually to each local teacher so nominated and approved, who shall teach on 60 nights at least in the year, and give satisfaction to the managers by his character, conduct, and attention to duty. The local teachers will, however, probably be required by your Committee of Managers to teach on two nights in each week during about forty or forty-five weeks, or nine or ten months in the year. The Committee of Council also require that the sum received in fees at the evening school during the year shall equal or exceed the £10 granted by them.

"One such local teacher may be selected by the Committee of Managers of each local Institution in the East Lancashire Union for nomination and approval; and if there be well attended female classes, an application will likewise, if desired, be made by the Council for the sanction of a female local teacher, if an efficient one be selected for their approval. It is desirable that these selections should be made in the first week of December, 1857, and notified to Mr. Sutherland, in order that arrangements may be made with Her Majesty's Inspector for a collective examination of both male and female candidates before Christmas next. The examination will be in no respect difficult, but will be strictly such as is necessary to ascertain that the persons selected have a fair knowledge of the elementary subjects before enumerated, and aptitude to teach them.

"The Council of the Union are also authorised by the Committee of Council on Education to appoint masters holding certificates of merit as organising masters in the Union.

"The duties of these masters will be as follows:—

"1. They will visit and teach the evening-classes the ordinary subjects of instruction in any Institution ready to pay at the rate of £15 for one night of such instruction weekly, during the usual time the classes are open in the year.

"4. They will be specially charged to act under the direction of the local managers, in organising the evening classes for collective teaching; and on nights not appropriated to evening classes paying £15 per annum, they will visit occasionally such other Institutions as may desire their help to organise the classes, aid the teachers, and give them examples of efficient class-teaching.

"3. On Saturday evening they will visit in succession the several Institutions in the Union, and will give class lectures, illustrated by apparatus and experiments, chiefly in explanation of natural phenomena. For example, four class lessons might be given throughout the Union on (A) the mechanical, (B) the chemical constitution of the atmosphere; (C) the mode in which it may become noxious by chemical degeneration; (D) by miasmata, and the means of preventing both forms of evil.

"4. The organising masters will be employed as assistant-secretaries to Mr. Sutherland, and will regularly attend at an office and hours to be appointed.

"5. The Council reserve for consideration the propriety of opening, in Burnley and Accrington, classes during two or three hours in the day-time, for the instruction of assistants in shops, clerks, and apprentices, in the elements of mechanical, chemical, and other scientific knowledge, in surveying or in drawing.

"Each Committee of Managers will do well to bear in mind that the appointment of a local teacher, towards whose remuneration the Committee of Council will pay £10 annually, ought to lead to their availing themselves at once of the aid of the organising master for at least one night weekly. They will also doubtless feel that the weekly visit of the organising master will be most important, not only to the efficiency of the evening classes, but to the success of their local teacher in his new career, and also to that of the candidates for certificates and prizes in their Institution.

"I have to request that a copy of this circular may be put into the hands of every member of the Committee of Managers without delay, and that a special meeting may be at once called for its consideration. "I am, &c.,

"J. P. KAY-SHUTTLEWORTH.

"To the Secretary of the Committee of Managers of the Evening Classes or Mechanics' Institution at ——"

The following are the instructions to organising masters referred to at page 614.

"The East Lancashire Union of Institutions has been formed to foster the self-education of the youth of the labouring classes in this district, between the elementary school age and full maturity.

"It is essential to the proper discharge of your duties as organising masters, that you should have a sincere sympathy with such efforts as are made by thoughtful labouring men for this end.

"You can shew this sympathy in various ways.

"Your primary and most engrossing duty will be personally to teach the elementary classes of certain Institutions the rudiments of reading, writing, arithmetic, writing from dictation and from memory, English grammar, geography, and English history.

"Even the teaching of the humblest of these elements will require much of your attention. These labours will be greatly

lightened by organising the pupils of each Institution into classes, according to their acquirements, and by introducing as rapidly as possible the collective method of oral instruction, instead of the mode of individual teaching now, in many cases, in vogue.

"You will put yourself in personal communication with the gentleman of the local committee appointed for that purpose. You will be introduced by him to the teachers who have at present charge of the classes.

"You can then, with his consent, and their aid, ascertain the amount of knowledge possessed by each pupil, and then, with the like concurrence, proceed to arrange them in such groups as will facilitate collective instruction.

"You can explain to the Committee and the teachers the arrangement which you conceive will promote the most rapid success, by the division of the pupils into classes; by the use of one lesson book in each class; by setting apart a fixed period for each subject of instruction; by drawing up, in accordance with this, a written scheme of the routine of the classes; by settling with them what classes you are personally to teach, and whether, and if so at what period, you are to examine the other classes.

"The selection from the list of the Committee of Council on Education of proper lesson books will be indispensable, if the class has not sufficient for collective instruction. A grant may be obtained in aid of local subscriptions for this object.

"Such arrangements, if made with skill, constitute that organisation without which no permanent success can be hoped for in any school.

"These duties will occupy three-fourths of your time on the evenings in which you visit Institutions for elementary instruction.

"The remaining fourth part of the time each evening may, with the concurrence of the local directors, be devoted to a lesson to be delivered by you to all the members of the evening classes of the Institution. For this lesson they should be collected together in one class on a gallery, or by some similar arrangement.

"You will carefully prepare each week the notes of one or more lessons, to be then delivered to this aggregate class, in explanation of some natural phenomenon. Such subjects as rain, dew, winds, hail, hoar-frost, snow and ice, eclipses, thunder-storms, the aurora-borealis, meteors, falling stars, would form the subject of one series of lessons. Another might consist of the explanation of the breathing of animals, of plants, the sources of the nourishment of plants, the balance of organised nature as respects plants, animals, and men, &c., &c. The nature and uses of soils, the use of moisture, of drainage, of pulverisation of soils, properties of pulverised soils as respects gases and the mineral food of plants, the nature of different manures, and the mode in which each promotes fertility.

"These lessons must be given in the simplest language, with the least possible use of scientific terms. They should be the subject of questioning at the close of each lesson. Notes should be taken by all who are competent, and an examination on the subject of the preceding lesson should occupy a few minutes at the beginning of the time allotted to this instruction.

"As far as possible, such lessons should be illustrated by diagrams, drawn boldly by yourself, on large sheets of cartridge paper pasted together.

"Whenever it is possible to illustrate the lecture by some scientific apparatus or experiment, that should be done.

"If you find that any of these subjects are well-treated in any of the class reading-books in use in the Institution, you will do well to have this chapter read by the class, and to make your lesson consist of a development and illustration of this reading-lesson. The text should then be made a subject of separate study by the members of the class, and they should be invited and encouraged to purchase, for their own use, the class reading-book containing the lesson. The Committee of Council will facilitate this by allowing for books so purchased the large discount of 40 to 43 per cent., if they are on the published list of the Council.

"Saturday evenings will be devoted to a course of lessons on some subjects of natural science with which you are familiar. In the present state of the evening classes, and of the Union, the Council limit each course to a series of four such lessons. When they have been delivered at one Institution, you will proceed to give them at such other Institution as may be appointed by the Council, on four other Saturday evenings.

"The Council have selected as your subject for the first course of lessons, the 'Atmosphere,' chiefly because of the importance of the right understanding of sanitary arrangements in everything affecting the air we breathe.

"Your four lessons will consist of an explanation of the chief properties of the atmosphere:—1. The physical; 2. The chemical; 3. The mode in which the air degenerates by chemical and physical impurities; 4. By miasmata, and the best means of removing or preventing each form of evil.

"The Council recommend you to encourage the young men who attend these lessons to take notes. You should also be prepared to question them, but in a very simple form, and with abundant encouragement and aid, so as to enable them to carry away the chief facts and principles of your lessons. If any of your pupils are sufficiently advanced to write out what they can remember of the lecture, the Council would be prepared to reward such efforts by some mark of approbation.

"The Council have provided such apparatus as will be required for the illustration of this first course of lectures, which you will repeat throughout the Union. When that course has beeen completed, you will be furnished with apparatus for another course.

"Having thus devoted your first course of four lessons to 'Air,' it may be desirable to deliver four lessons in a subsequent course on 'Water,' chiefly with a view to give a clear knowledge of the composition and uses of water; of the common modes in which it is beneficial or hurtful to vegetable and animal life, whether as a solvent, or in the form of vapour, dew, rain, or stagnant on the surface, or in the interstices of the soil."

EXHIBITION OF 1861.

The following is extracted from the *Builder*:

"Public opinion appears to be steadily accommodating itself to the idea of an Exhibition of Art and Industry in 1861, and doubtless, when the Council of the Society of Arts reassemble, they will take some vigorous steps to put the matters in train. Something has been said about holding the Exhibition in Battersea-park, near the terminus of the West-end Railway. We trust, however, that no such notion will be entertained. The site in possession of the 1851 commissioners at Kensington and Brompton would be far superior, and indeed is specially marked out as the right place for the first of the decennial Exhibitions born of that of 1851."

MECHANICS' INSTITUTE, ROXBURG, MASSACHUSETTS.

This Institution has been in existence about a year and a half, and a brief statement of its progress may not be without interest.

The want of a Mechanics' Institute in Roxburg, was first suggested to several intelligent mechanics who had participated in the benefits derived from similar associations elsewhere. On making known their views, they were speedily joined by others who felt the same need. The objects which the founders of this Institution had at heart, to use their own language, were these: To create a more social feeling among mechanics; to supply some intellectual source of amusement and employment common to all; to awaken dormant talent; and to elicit such information, and to give such special instruction to the artizan, as will tend to the most successful execution of the details of his business, excluding everything which might appeal to sectarian, national, or political prejudices. To promote these desirable objects, a class has been formed for instruction in architectural and ornamental drawing, under the supervision of a gentleman who is an accomplished master of that art, as well as a skilful practical mechanic, and a debating class has been established, which is found to be of great benefit in enabling its members to express their ideas fluently and with self-possession. It is also proposed, if required, to open classes for instruction in Arithmetic, Algebra, Geometry, Grammar, &c., to all of which sons and apprentices of members, as well as members themselves, will be admitted free.

Several courses of lectures have been delivered, to some of which, members, with their families, have had

free admission; a reading room has been opened, and well provided with newspapers and magazines, to which members can have access every evening; and a library has been collected partly by donations, and partly by purchase, consisting of histories, biographies, travels, expeditions and surveys, and a few works of fiction, also many books valuable for reference, being reports published by order of the general and state governments, and others of a scientific and mechanical character.

Two hundred and ninety-eight persons in all have belonged to the Institute since its formation.

Of this number there were:—3 Apothecaries, 1 Architect, 3 Bakers, 1 Brewer, 3 Booksellers, (one of whom is a Book-binder), 1 Brass Moulder, 1 Brass Finisher, 2 Book Keepers, 1 Box Maker, 4 Boot and Shoe Makers, 4 Blacksmiths, 1 Broker, 1 Builder, 1 Bank Commissioner, 41 Carpenters, 1 Cabinet Maker, 4 Carriage Builders, 1 Carriage Painter, 14 Curriers, 1 Cashier, the City Clerk, 7 other Clerks, the City Treasurer, the City Marshal, 6 Clock Makers, 2 Coal Dealers, 1 Chemist, 1 Cigar Maker, 2 Clergymen, 1 Confectioner, 1 Designer, 2 Editors, 1 Engraver, 1 Fringe Weaver, 1 Furniture Dealer, 1 Fish Dealer, 1 Farmer, 2 Grocers, 1 Hatter, 1 Hard Ware Dealer, 4 India Rubber Workers, 2 Iron Founders, 1 Junk Dealer, 2 Lithographic Printers, 3 Lawyers, 21 Machinists, 5 Masons, 1 Manufacturer, 2 Moulders, 19 Merchants, 1 Organ Pipe Maker, 1 Paper Hanger, 1 Paper Stainer, 8 Plasterers, 5 Physicians, 2 Picture Frame Makers, 3 Pattern Makers, 13 Painters, 2 Printers, 1 Provision Dealer, 18 Piano-Forte Makers, 1 Pump Maker, 2 Policemen, the Post Master, 2 Patent Leather Japanners, 5 Rope Makers, 1 Stair Builder, 1 Surveyor, 1 Silversmith, 3 School Teachers, 1 Stable Keeper, 2 engaged in Sawing and Planing, 4 Tin Plate Workers, 3 Tailors, 1 Teamster, 3 Wheelwrights, 1 Wood Turner, 18 persons whose occupation is not known, 4 minors, not engaged in any trade, and 5 gentlemen living on their income.

An Institution of this kind must expect to meet, for the first year or two, with much to retard its progress; many will not join it until they see it established beyond the possibility of a failure; and many more who do not connect themselves with it, will feel disappointed if they cannot see it carried into successful operation at once.

This enterprise was something entirely new to most of those who undertook it; the Directors were almost entire strangers to each other, almost wholly ignorant of one another's capabilities, of the peculiar wants or wishes of the members, and of the best methods of putting such plans as might be adopted into practice. All of these obstacles, time has, in a great measure, removed; and as the usefulness of the association becomes more apparent, just in that degree has it gained the favourable opinion of mechanics and the public.

JOINTED SHIPS.

An important innovation in steam shipping is now being carried out by the Jointed Ship Company, who are running the "Connector," a jointed steamer, in the London coal trade. The vessel is built in three distinct sections or compartments, on the plan patented by Mr. MacSweney. The sections are coupled together by a joint of great simplicity and enormous strength, which admits of instantaneous disconnexion of any one section from the others when required. One section contains the engine and the crew, and the other two are exclusively cargo sections. On this system the joints are all made to one guage, so that the engine section can be applied to any number of other sections or vessels. The commercial advantages obtained by this novel system of steam shipping are stated by the projectors to be the facility afforded by avoiding the detention of the present costly marine engines and staff during the loading and unloading of cargo and repairs of tonnage, as the jointed engine section can always be transferred from one vessel to another joint, as the locomotive is from one train to another. The feature of this plan is that on long steam routes by river, lake, or coast, cargo sections can be picked up, jointed on, and taken forward or disconnected and left behind, with about as little delay as a railway train can be increased or diminished. A further advantage claimed is that jointed vessels (up to 2,000 tons) can be constructed of so light a draught—say five feet—that their sections may be loaded at inland ports and proceed, by shallow river, lake, or canal, to a seaport, there be jointed to the engine section, and take their cargoes direct over sea, avoiding the expense and delay of transhipment. The "Connector" has recently made a successful voyage to Hartlepool, and has discharged a cargo of coals from that place in the Regent's-canal dock.

DISEASE OF THE SILKWORM.

The committee appointed by the Academy of Sciences to investigate the cause of the diseases of the silkworm, and seek a remedy for them, recently met to receive the report of the three members who had been specially charged with the duty of investigating the subject in detail. The reports of MM. Decaine and Péligot, which had particular reference to the state of the mulberry leaves, were very short, but M. de Quatrefages has conducted a number of observations and experiments of a very interesting and important character. Having visited various parts of France, he found the mulberry leaves in excellent condition, from which it appears that the source of the disease in not to be attributed to bad food. The disease called by M. de Quaterfages *ma.adie de la tache*, from the spots which appear on the worm when attacked with it, is that from which these animals principally suffer. These spots are often invisible to the naked eye, and can only be perceived with the aid of a magnifying glass; and this circumstance explains why the malady, especially during the present year, escaped the observation of silk-growers in the majority of cases until five or six days after the worm had cast its fourth skin. The spots exist in all the tissues and organs of the worm, and in its subsequent stages of a chrysalis and moth. In the latter, the spots destroy the antennæ, the legs, or a portion of the wings. In the beginning, the spot appears under the form of a yellowish matter pervading the whole system; this matter gradually becomes darker, and is then concentrated into a number of tubercles, which are the spots in question. That such a diseased state should exercise an influence on the quality of the eggs is not surprising, but to what extent can only be determined by future experience. An infected silkworm may spin its cocoon when the disease is not too far gone, but the insect generally dies, and the body, instead of putrefying, becomes dry and brittle. Several methods of cure have been tried: first, the hygienic process, which consists in rearing the worms in open sheds instead of close rooms. The leaves of the wild mulberry, not stripped from the branches, have been found very efficacious. Silk-growers are recommended to rear small lots of worms apart from the others, solely for the purpose of propagating the species. Various medicines have also been administered to the worms. It appears that the silkworm does not refuse to eat the leaves of the mulberry sprinkled with Peruvian bark, valerian, mustard, &c., and the two latter powders especially would seem to produce good effects. Scraped sugar, however, appears, for the present, to be preferable to all other remedies. Experiments with this substance were accordingly repeated on a larger scale in an establishment where one of the silk sheds fitted up for 27 trays was reduced by disease to four. The worms of these were transferred to another shed, and divided into four lots; the first was fed in the common way, the second with moistened leaves, the third with sugared leaves, and the fourth was subjected to a rigorous abstinence from food

for a considerable time, and then fed chiefly with sugared leaves. At the end of 24 hours, several worms of the latter lot began to spin, and made several small and imperfect cocoons; the other worms began to shrivel up and diminish in size; but on receiving the sugared leaves, they speedily rallied, and many of them spun their cocoons. The worms fed with moistened leaves fared very badly, and very few of them spun cocoons. Those fed in the common way presented nothing remarkable, and yielded a certain quantity of cocoons; but those fed with sugared leaves throve well and spun their cocoons sooner than the others. The quantities of silk yielded by these four lots were respectively: 1st lot, 210 grammes; 2nd lot, nothing; 3rd lot, 392 grammes, and of a superior quality; 4th lot, 152 grammes. It seems to be thus established that medicines may be administered to silkworms with results which may be considered very promising.

Proceedings of Institutions.

Bradford (Yorks).—In the twenty-sixth annual report of the Mechanics' Institute presented to the members at the last annual meeting, the committee regret that the terms of encouragement with which for the last few years they have been accustomed to preface their remarks, cannot on this occasion be quite so appropriately employed. There has been a decline in the number of members, but it is some satisfaction to know that this has originated in no deficiency in the number and value of the privileges enjoyed; but it is almost entirely attributable to the very severe depression in trade. Under these circumstances, therefore, the committee confidently hope that, on the advent of more favourable times, the Institute will recover the ground it has lost. The following is a comparative statement of the number of members for the last two years:—

	March 31, 1857.	March 31, 1858.	Decrease.
Life Members	128	128	—
Members at 12s. per annum ...	496	476	20
Subscribers at 10s.	198	153	45
„ 8s.	394	326	68
Females at 6s.	86	64	22
Firms...	12	11	1
Persons nominated by firms ...	94	82	12
	1408	1240	168

The financial position of the Institute presents a very favourable aspect. The gross income of the year, including £59 9s. 6d. the balance of last year's accounts, has been £761 10s. 9d., and the expenditure £690 11s. 7d., leaving a balance in favour of the Institute of £70 19s. 2d. The news and reading-rooms continue to maintain their popularity among all classes of the subscribers. During the year the usual number of newspapers, magazines and reviews have been supplied; the committee have also continued the telegraphic intelligence, feeling satisfied that rapid information on important events has now become a necessary element in the arrangements of a news-room of any pretentions to completeness. The additions to the library during the past year have been:—By purchase, 250 vols.; by bound periodicals, 44 vols.; by donations, 16 vols. Thirty-three volumes have also been purchased to replace worn-out books. The number of volumes at present in the library, after deducting the loss of twenty-seven volumes incurred by change of editions and by the erasure from the catalogue of books worn-out and superseded by later information, is 6,944. The general summary of the issue of books, as compared with that of the previous year, presents a decrease of 2, 575. Considering, however, the decline in the number of members, and the fact that this has occurred chiefly among those classes of the subscribers who make most use of the library, the result is one which might be fairly anticipated, and affords no evidence of any diminution in the reading habits of those who continue to subscribe. The proportions of books issued in the several departments of literature are fully stated in the following table:—

—	Number of days the Library was open in each month.	Philosophy, Philology, Logic, Education. A	Theology, Morals. B	Mathematics. C	Natural Philosophy, Mechanics. D	Chemistry, and its applications. E	Anatomy, Physiology, Medicine. F	Natural History. G	History and Antiquities. H	Biography. I	Geography, Voyages, Travels. K	Political Economy. Government. L	Poetry, Drama. M	Fiction. N	General Literature. O	Fine Arts, Architecture, Music. P	Encyclopaedias, Works of Reference. [illegible]	Periodicals bound. S	Periodicals unbound. T	Total monthly issue.	Average daily issue.	Average daily issue of last year.
1857-8.																						
April	25	58	26	20	41	29	29	98	217	278	401	24	149	774	370	57	17	198	190	2976	119.01	132.06
May	26	49	28	19	58	21	32	125	189	272	324	24	148	757	344	66	8	214	172	2850	109.16	120.15
June	26	58	13	24	37	16	19	95	134	220	266	30	93	680	243	44	14	169	158	2313	88.25	100.20
July	27	34	20	17	34	5	30	68	115	163	273	18	88	651	233	43	9	139	149	2089	77.10	84.10
August	13	17	6	15	10	7	14	41	72	102	177	7	72	406	134	28	9	80	80	1277	98.03	102.00
September...	26	40	32	22	28	16	32	90	164	212	317	22	119	708	289	48	13	147	144	2443	93.25	100.21
October	25	67	31	29	74	37	46	107	269	342	458	37	209	856	436	69	12	227	168	3474	138.24	145.14
November...	25	72	49	32	58	28	34	105	308	314	438	37	189	843	395	80	11	220	187	3400	136.00	136.21
December...	27	57	41	23	42	22	28	98	241	294	435	20	186	854	375	64	11	206	167	3164	117.05	117.18
January	27	68	35	28	35	24	34	91	220	277	438	25	123	881	329	70	11	226	159	3074	113.25	126.13
February	24	64	20	30	46	24	28	106	202	261	339	34	148	719	287	59	15	191	127	2700	112.12	122.20
March...	27	59	26	29	64	31	34	82	186	264	382	50	157	656	342	68	11	259	174	2874	106.12	119.00
Total	298	643	327	288	537	260	360	1106	2317	2999	4248	328	1681	8785	3777	696	141	2276	1875	32622	108.96	117.04
Total last year... ...	297	672	349	244	632	316	362	1067	2800	2955	4486	354	1946	8954	4165	917	135	2617	2226	35197		
Increase	1			44				39		44							6					
Decrease		29	22		95	56	2		483		238	26	265	169	388	221		341	351	2575		

The following is a statement of the lectures delivered during the past session. Those marked by an asterisk were gratuitous. Rev. J. Smith, "On India;" Geo. Grossmith, Esq., "A Humourous Lecture on Lecturing;" J. W. Ebsworth, Esq., "Personal Characteristics of Shakspeare;" and "Art Treasures and Artists;" Rev. G. W. Conder, "Laws of Life—Compensation;" *Rev. J. Gregory, "West-Riding Dialect;" Geo. Dawson,

Esq., M.A., "Beau Brummell;" * Mr. S. H. Kerr, "Electric Telegraph;" Mr. J. K. Applebee, "Douglas Jerrold;" Mrs. G. L. Balfour, "Celebrated Women of England, America, and France;" Mr. W. Richardson, "Electricity, Galvanism, and Pneumatics;" Geo. Grossmith, Esq., "Pickwick Papers;" and "English Notions of American Character;" *Rev. S. G. Green, B.A., "Old Times: how to understand them, and what they teach;" *Rev. J. Fawcett, M.A., "On some of the Former Inhabitants of our Old Town and Neighbourhood." The classes have been in full operation during the session, and the number of them similar to that of the previous year. In the principal class—that for writing and Arithmetic—the attendance has been very good, and the teachers report that in point of usefulness and efficiency it has never previously been in better condition. The addition of two new class-rooms, which were fitted up early in the session, one of which was appropriated to the use of this class, has materially contributed to this result, as the teachers have thereby been enabled to effect a more complete subdivision of the class according to the age and attainments of the pupils. The grammar and reading classes form another feature in this department, to which too much attention can scarcely be paid. Examinations by the Civil Service Commissioners, and those conducted by the Society of Arts, have plainly demonstrated how urgent is the need for a thorough inculcation of the first principles of orthography and English composition, without which any aims at higher attainment must be inevitably impeded, or altogether prevented. Much attention has been given during the past session to these important subjects. The committee express an opinion that it would be well if a class exclusively devoted to writing from dictation, were permanently established. The higher classes have been efficiently conducted, and the attendance of pupils very regular during the Session; the female class forming the only exception to this remark. In this class the reduction of members became very great during the last quarter. The following table gives the number of pupils, and the average attendance in the classes taught during the past session. The classes marked by an asterisk were taught by gratuitous teachers, to whom the Institute is very greatly beholden for their valuable services:—

Name of Class.	No. on Books.	Average attendance.
Writing and Arithmetic	203	120
Reading—two Classes	74	56
*Elementary Grammar:—		
First Section	37	21
Second Section	18	10
*Advanced Grammar	40	23
*Higher Grammar	15	11
*Geography	22	15
*English History	15	10
*Mathematics	13	8
*Bookkeeping	18	13
*Chemistry	10	9
*Latin	7	4
French—Four Classes	42	40
German—two ,,	13	11
Drawing	37	30
Female Class	42	23

The usual annual soiree was held in the theatre of the Institute, tea being previously served in the newsroom to about two-hundred of the members and friends of the Institute. The president occupied the chair, and distributed prizes to the successful students in the classes.

SYDNEY (NEW SOUTH WALES).—The report of the Sydney Mechanics' School of Arts for the past year, states that its prosperity may be considered as unimpaired, for the slight decrease in the number of members is less than might have been anticipated from the late depression of mercantile interests. The committee point with satisfaction to the multiplication of provincial Institutions, of which this society may be considered the parent. The extent to which the reading-room is frequented, affords full justification to the committee for the heavy expenditure which that improvement necessitated. The evening attendance is already sufficient to occupy it fully, and a moderate increase in the number of readers will demand additional space. The condition and wants of the library have had a large share of the committee's attention. They found that a considerable infusion of fresh books was required, not merely to make good the actual wear and tear caused by the rapid circulation of well-known works, but also to keep pace with the intelligence of the day. The opportunities of procuring desirable publications in the colony have proved insufficient, and though the committee have expended the sum of £85 16s. in purchasing on the spot books most urgently needed, yet they do not consider a reliance upon this market to be prudent, and they have directed their attention to the mother country for better supplies. Already the sum of £100 has been remitted to a large house in the book trade, with a corresponding order. The committee have also voted £50 to be expended under the care of the Society of Arts in England. The additions of all kinds to the library, during the year, are about 653 volumes, making the present stock about 6,500 volumes. The lectures still retain the character which Lord Brougham, borrowing a medical term, describes as "sporadic." Even in England, with its abundant supply of able and willing lecturers, Mechanics' Institutes have found it necessary to associate themselves into unions, in order to secure continuous courses of lectures from competent teachers. The committee feel that a more systematic course of instruction would be highly desirable, but the condition of the society in the colony has hitherto rendered this impracticable. The aid accorded by his Excellency the Governor-general, the patron of the Institution, demands especial recognition. The list during the year comprises:—"Introductory Lecture," Dr. Woolley, Principal of the Sydney University; "On Elocution, with illustrations from Shakspeare's plays," Mr. John Connery; "On the friendly Intercourse of Nations," The Rev. John West; "On Common Salt," Dr. Smith, Professor of Chemistry at the Sydney University; "Photography," Frank Haes, Esq., Member of the Photographic Society of London; "The Distinguishing Characteristics of the Present Age," C. Smith, Esq.; "The Phenomena of the Tides of the Pacific Ocean," Captain M. Denham, F.R.S., of H.M. Surveying Ship, Herald; "Animal Magnetism," Mr. F. M. Thompson; "The Aborigines of Australia," J. H. Palmer; "The History and Use of Music," Dr. Hoelzel, Chief Rabbi; "Land Surveying," His Excellency Sir William Thomas Denison, K.C.B., Governor-General; "The Microscope, its Uses and Results," George Walker, Esq.; "The Analogies existing between sound and colour, with a description and comparison of the organs of vision and hearing," J. D. Macdonald, Esq., H.M.S. Herald; "Savings' Banks," Christopher Rolleston, Esq., Registrar-General; "Life and Writings of William Shakespeare, with musical illustration," A. J. Mason, Esq.; "Ventilation," Isaac Aaron, Esq., Health Officer of the City of Sydney; The Revolt in the Bengal Army," Dr. Berncastle; "The Modern Doctrine of Protection to Native Industry," W. G. Pennington, Esq., Vice-President; "The Political Economy Proper for New South Wales," W. B. Allen, Esq.; "Civilization," A. Bennie, Esq.; "The Poetry of Charles Harpur," D. H. Deniehy, Esq., M.L.A.; "Description of a Voyage to Norfolk Island, with an account of the Pitcairn Islanders settled there," His Excellency Sir W. T. Denison, K.C.B., Governor-General; A Special Lecture on the "Meaning and Tendencies of the Present Age," kindly delivered by E. Maitland, Esq., President of the

Goulburn School of Arts. The classes at present in operation, are,—a French class; a Drawing class, in which, during the past year the majority of the pupils have attended to Mechanical Drawing, a department of special value in reference to the development of the sources of colonial wealth; a Mathematical class; a German class; a class for instruction in Elocution; one for Instrumental music; Singing classes; a Latin class; and a Discussion class. The committee say, however, that they cannot congratulate the society upon such a general development of the class system as might be desired. The subjects of study are few and limited; nor does the attendance in the several class-rooms indicate any great zeal or interest on the part of the general body of our members. The committee add:—"This is an old complaint in similar institutions. It flows naturally from the peculiar circumstances of disadvantage under which our pupils for the most part pursue their studies. Their work is much harder than that of scholars in Colleges or Universities, whilst they enjoy none of those encouragements by which academic diligence is stimulated and rewarded. An attempt has been made in England to remedy this evil by examinations and rewards to meritorious students. These examinations in the London Society of Arts have assumed a very elaborate character, and are recognised as conferring a distinction only second to University diplomas. It is worthy of consideration whether this system may not be wholly or partially adopted in our own Society." "The attention of the committee has been earnestly directed to the subject of competitive exhibitions of useful invention, similar to those which have been so effectively employed by the London Society of Arts in stimulating scientific and literary industry, and developing the material resources of the country. A sub-committee has been appointed, with instructions to draw up a scheme for carrying this project into effect, and upon their recommendation the committee offered for competition four medals. Of these, two were assigned to the mechanical arts, and the subject selected for the present year was "Model Dwelling-houses for the Labouring Classes," especial regard being had to the peculiar circumstances of the colony and to economy. The others were allotted to pictorial and plastic arts. Two gold medals were added by individuals, one by Dr. Woolley, for the best essay upon a literary subject; the second by A. T. Holroyd, Esq., for the best model of a machine to extract the stumps of trees from the earth. The following is a comparative statement of the number of members on the books in each quarter, for the years 1856 and 1857:—

In the first Quarter,	1856, there were	646;	in 1857, 667.
Ditto second ditto,	1856, ,,	759;	,, 1857, 751.
Ditto third ditto,	1856, ,,	999;	,, 1857, 911.
Ditto fourth ditto,	1856, ,,	1035;	,, 1857, 952.*

It appears by the accounts that the revenue has sufficed for the year's expenditure, but has not left any surplus. The committee closing their report desire to bear testimony to the energy and ability of the late secretary, Mr. Joseph Dyer. The vacant office was applied for by forty different gentlemen. From these the committee have selected Mr. William Davis, whose antecedents lead them to believe that he will prove an efficient officer.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Aug.* 27, 1858.]

Dated 27th July, 1858.

1693. A. Taylor, 1, Wellington-cottages, De Beauvoir-town, Kingsland—Imp. in pianofortes.

Dated 4th August, 1858.

1773. C. M. Archer, 3, St. James'-gardens, Haverstock-hill, Hampstead-road—Imp. in electric and submarine telegraph cables and wires.

Dated 11th August, 1858.

1825. S. F. Cottam, Manchester—Imp. in machinery for doubling cotton and other yarns or threads.
1827. J. B. Foyce, St. Dunstan's Works, Conway-street, and J. Cure, J. Boyes, and J. Clough, Ebenezer Mill, Mill-lane, Bradford—Imp. in machinery or apparatus for combing wool and other fibrous materials.
1829. R. A. Brooman, 166, Fleet-street—Imp. in time-keepers. (A com.)

Dated 12th August, 1858.

1831. W. Meckel, Friday-street—Imp. in textile fabrics.
1833. J. Scott, Shoreham, and A. Martinucci, Brighton—An improved steam engine.
1835. J. H. M. Maissiat, Paris—Imp. in wheels.
1837. J. Fogg, Great Lever, near Bolton, Lancashire—Imp. in pressure gauges.
1839. A. J. Paterson, Edinburgh—An imp. in propelling ships and vessels.
1841. E. Smith, Dudley Port, Tipton, Staffordshire—An imp. in puddling iron.
1843. H. Smith and T. W. Ashby, Stamford—Imp. applicable to haymaking machines, whereby such machines are rendered useful for other agricultural purposes.

Dated 13th August, 1858.

1845. W. B. Nortcliffe, Fellgrove, near Huddersfield—An imp. in dyeing woollen, worsted, cotton, silk, linen, and other textile fabrics and fibrous substances.
1847. F. J. Manceaux, Paris—Imp. in stocks for fire-arms.
1849. T. Rickett, Castle Foundry, Buckingham—Imp. in locomotive engines and other carriages to facilitate their transit.
1851. T. Worth and H. Spencer, Rochdale—Imp. in machinery or apparatus for preparing for spinning, and for spinning, cotton and other fibrous materials, in winding and warping yarns of the said materials, and in making wire cards for such preparing machinery.
1853. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the treatment of crude india-rubber, gutta percha, or other vulcanizable gums, and in the manufacture therefrom of what are usually called hard rubber articles. (A com.)

Dated 14th August, 1858.

1855. J. Cartmel, Stamford-street—Imp. in the manufacture of hats, caps, and other coverings for the head.
1857. J. Holt, Shelf, near Halifax—Imp. in looms.
1859. A. Slate, Adelaide road, Haverstock-hill—Imp. in blast furnaces and in smelting iron ore.
1861. C. O'Neill, Manchester—Imp. in the manufacture of artificial gums from starch farina, and other amylaceous substances, and in apparatus for such manufacture.
1863. W. E. Newton, 66, Chancery-lane—An improved combination of metal with india rubber or gutta percha, or with india rubber or gutta percha combined with other substances, in the manufacture of belting, hose, valves, and other articles.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1880. A. V. Pinta, 63, King William-street—Imp. in blank-forms of cheques or drafts on bankers, payable on demand, relating to the crossing of such cheques or drafts.—18th Aug. 1858.

WEEKLY LIST OF PATENTS SEALED.

August 27th.

391. L. Galli.
397. J. G. Newey and W. M. Newey.
399. A. von Schuttenbach.
401. J. K. Field.
403. H. M. Platt.
406. J. Billing.
407. J. Skelly.
408. J. Bircumshaw.
410. A. Ripley.
412. W. Hooper.
471. J. P. Budd.
493. F. A. Verdeil.
500. T. Thompson.
528. J. Hamilton, jun.
542. W. S. Clark.
545. T. C. Hine.
625. W. S. Clark.
631. F. Haeck.
667. E. A. Jacquin.
805. M. A. F. Mennons.
1034. A. V. Newton.
1291. A. Robertson.
1402. W. E. Newton.
1438. J. Taylor.
1499. J. Chisholm.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

August 23rd.

1921. C. Schlickeysen.
1926. W. Brown.
2005. W. Southwell.

August 24th.

1927. C. F. Stansbury.
1929. E. Carless.

August 25th.

1941. W. Johnson.

August 26th.

1964. P. E. Charton.
1976. A. I. Austen.
2002. W. De la Rue.
2026. J. Stewart.
2032. R. B. Feather.

August 27th.

1943. C. Esplin.
1948. E. N. Fourdrinier.
1954. C. Radcliffe.

* To which must be added a considerable number who have neglected to take up their tickets punctually on the expiration of the term, say 150; making a slight increase of members on the 31st December, 1857, over the 31st December, 1856.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 10, 1858.

NOTICE TO INSTITUTIONS.

The Prizes and Certificates awarded at the Examinations held in May last, have been forwarded to the several Local Boards for distribution.

Copies of the Programme of Examinations for 1859 may be obtained on application to the Secretary of the Society of Arts.

ENGRAVING.

An invention has recently been patented in this country, for preparing the surface of an engraved copper-plate so as to render it capable of yielding a greatly increased number of impressions. It is stated that upwards of ten thousand impressions have been taken from a plate thus prepared. A description of the process will shortly be given in the *Journal*.

ON THE MANUFACTURE OF AUSTRALIAN WINES.

By P. L. Simmonds.

The recent samples of raisins and olive oil from Western Australia, and the trade opinions thereon, published in the *Journal*, have drawn my attention to the subject of new colonial products suited for export, and I should have been glad if the long continued efforts of the Society, by the offer of premiums and the suggestions thrown out, had resulted in some greater degree of enterprise and more extensive results among the colonists. Western Australia has, it is true, laboured under many disadvantages of want of labour and capital, and been thrown sadly in the background by the superior attractions of the gold-fields of Victoria and New South Wales, and the mining and agricultural operations of South Australia.

Just fifteen years ago, my friend the late Mr. R. W. Nash, an earnest and devoted friend to improving the old and developing new resources for the colony with which he was identified, established at Perth a Vineyard Society, for the following objects:—

"To ascertain and preserve the numerous varieties of the grape-vine now in the colony.

"To introduce all such useful varieties as we do not already possess.

"To prepare and publish information on the best treatment of the vine, and manufacture of its produce.

"To encourage the formation of vineyards, and the manufacture of the produce.

"To obtain periodically from the members of the society such observations as may have occurred to them in the treatment of their respective vineyards, the qualities of their vines, &c.; so that the committee may be enabled to communicate to the public the general results.

"To obtain and preserve a high character for the wines, brandies, Zante currants, and raisins of Western Australia, by discountenancing the exportation of inferior qualities, and by the society's brand accrediting the superior.

"To form a model vineyard, where all attainable varieties of the vine should be preserved and propagated, for the purpose of trying experiments on their treatment, and on the manufacture of the produce, as well under various treatment, as with various combinations of grapes, and from which cuttings should be furnished to the members at a fixed rate."

At the first meeting, held the 8th June, 1843, a beautiful sample of Zante currants, in their dried state, which had preserved the bloom uninjured, and produced in his own garden, was shown—and much admired—by Mr. Mackie.

And yet, in the long interval that has elapsed, when the suitability of the soil and climate, and its capability to produce grapes, raisins, wine, olive oil, and other important products, have been fitly proved, how little has been really done, in a commercial point of view, either for local consumption or export. While there is little encouragement for the shipment of dried fruit to England, owing to the long voyage and the heavy charges, there are excellent markets at hand, as consumers, in the various Australian Colonies, and in Mauritius and Bourbon. But the colonists seem too prone to rest satisfied with putting the matter of successful production simply to the proof, and then weary of following out the matter in a speculative point of view.

A late number of the *South Australian Register* says:—"We have been favoured with a sample of raisins, the produce of a vineyard at Norwood, which has been dried during the present season. They are plump and sugary, not too much dried, and rich in flavour. If raisins of this quality can be produced here in abundance, and there is no reason to suppose that they cannot, Australian housewives ought not to be long compelled to pay one shilling a-pound for their fruit for puddings. We sincerely hope that this branch of industry may be extended, as well as wine-making and spirit distilling, so that the produce of our vineyards may be turned to the best possible account, both to the growers and to the community."

It is remarkable that a process so exceedingly simple as that of drying grapes so as to produce raisins, should not be more attended to in the southern colonies for the purposes of trade and commerce.

For this purpose it is only neccessary to raise mounds of earth against a wall so as to present a sloping surface towards the meridian sun, at an angle of about 30° or one-third of a right angle. The bare red soil—warmed by solar heat, kept dry, and protected from rain or dew, is considered to possess properties for drying the grapes into raisins preferable to any other sort of surface, or any artificial heat. A useful sized slope is one about 26 feet from the upper to the lower horizontal line, and of the same width. This should be divided into two compartments of 12 feet wide (leaving 2 feet between them) by two planks fixed on edge and supported by stakes and cleats at the lower edge. Down the middle of each compartment should be a central sleeper to support covering boards, which ought to be cleated so as to be kept in their places, and overlap so as to form a boarded roof for each partition. These boards must be lifted on every evening, and taken off every morning, and laid on whenever rain is about to fall. The grapes should be laid down in separate bunches on the naked earthy surface, where, in the space of from six to twelve days, they will become brown; they must then be turned—once turned only—and in from two to three weeks in the whole they will be converted into raisins. In turning the grapes care should be taken to touch the fruit as little as possible. In order to prevent the contact of ants, it will be necessary to surround the basis of the slope on every side with water, which a very little ingenuity will contrive without affecting the dryness of the mound.

Few people are, perhaps, aware of the amount of the revenue derived by Spain from this article of commerce alone. The country consuming the most of the raisins thus produced is North America. Next comes England, then France.

Then, again, in the matter of Australian wines, which

would pay well for shipment, or even for local consumption if due attention were but given to the culture, management, and preparation of the wine. We have seen what an impetus has been recently given to Cape wines here, and those not of the best, but cheap colonial wine would always find a market, and take the place of much of the inferior continental wines.

The cultivation of the vine in Australia is as yet only the pursuit of a few wealthy landowners, who carry it on in the spirit of amateurs, as a branch of horticulture. It is more a fancy than an industry; and has not told with any appreciable effect on the taste or commerce of the colony. Hence, though we hear frequently of the wine of Australia, it is all sample and no bulk. It figures prominently in reports, as recently in Paris, and in nearly all the books about the colony; but it has not yet found its way into the ledgers and cellars of "the trade." The few wine-growers of the colony are too easily satisfied with proving that it can be produced, and it must be admitted they have proved it. But the period of experiment in this matter has exceeded all reasonable limit. The work wants a little pushing from the spirit of gain. Industries that potter on in the state of infancy for a generation are apt to be slighted and forgotten; dwelling continually in the region of expectation and promise, they rank at last with the sea serpent and the "coming man." In some such limbo is the wine trade of Australia, and there it is likely long to remain.

The last official return of the number of acres under cultivation with the vine in New South Wales, states it as a little above 1,000—about half the area of a single farm in the colony. Most of the produce is consumed in the establishments of the growers, but much of this small producing power is wasted by their mania for imitating or rivalling the choicest European varieties, and the struggle to obtain indentity with them in colour and flavour. If there is any little surplus the public know nothing of it, the growers, as a body, having taken no effectual steps to make it accessible.

One may be long in the colony itself without hearing that such an article exists. The city of Sydney is populous and wealthy, by no means averse to vinous fluids in any form, but indeed rather remarkable among capitals for chronic thirst—the climate conducing thereto. It supports a host of wine agents, wine merchants, and wine firms. Auction sales of wine are advertised daily in the local papers. A transaction of 10 minutes will stock your cellar with the "best brands" of all the wines in the universe, except those of Australia. Nowhere is the wine of the colony to be seen; even to taste it is difficult; it can only be done at a few good men's feasts, or at the houses of the growers. So may the privileged partake of rarities at the Duke of Devonshire's. But it is not an affair of commerce. There is no native wine "in the market," where only the great mass of the public can become familiar with it. There is not a shop, depôt, or establishment in Sydney where a pint can be bought over the counter. If you were to ask an Australian innkeeper for a bottle of wine "the growth of the country," you would create as much astonishment as if you made the same demand in a Highland boothie.

The only prospect I can see of wine being (in the commercial sense) produced in Australia, is that the cultivation of the grape may, hereafter, be taken up by a class of men who will make it their trade and live by it; who will have the good sense not to imitate Chambertin and Bordeaux, but grow a good pleasant quality, "racy of the soil," rich with its southern sun (such qualities there are), and in larger and larger quantities as the demand increases—in vintages, comprehensive measures—pipes, tuns, and butts—are what the world respects. The small annual "squeezes" that may be guaged by gallons, and only appear in public in sample bottles, are very properly treated as of no account. Let the Australian wine-growers enlarge the borders of their vineyards, cease being too curious in exquisite varieties, and aim at quantity from the two or three sound stocks they have already obtained. When they have freighted their first half-dozen ships to the London Docks, people will begin to believe Australia is really a wine-producing colony.

A writer, speaking of South Australia, says the grape is destined to become one of the prime fruits of South Australia. It grows with a luxuriance and vigour on all soils altogether unknown in Europe, and produces fruit in miraculous profusion. Every cottager, with no more pains than he would give to a cabbage, may have his vine covering his dwelling in a couple or three years, groaning with this luscious produce, and rewarding, with a generosity unknown to other plants, the small labour bestowed upon its culture. South Australia may be made a wine producing country to any extent, for there is no part of the soil unsuited to the growth of the vine. Four hundred different sorts are in the colony, selected from the best vineyards of France, Italy, and Spain, and the cost of planting and preparing a vineyard would not exceed from £8 to £20 an acre, according to the locality or the soil. From 450 to 1,200 gallons of wine is the produce per acre of a vineyard in its fifth year. An acre is estimated to yield, after the sixth year, a profit of £200 per annum. The grape ripens in Australia in January, and the fruit continues to be gathered till the end of May. Raisins of very good quality have been made from the White Muscat of Alexandria, with no other trouble than cutting off the branches and laying them on mats in the sun to dry.

By the latest returns there are about 800 acres of land in cultivation as vineyards in South Australia. There can be no question of the capabilities of the colony for the production of wine. I do not mean a mere *vin ordinaire*, but wines of a superior class. Many of the wines already produced give promise of possessing a distinctive character, together with those qualities which render them most valuable — colour, bouquet, flavour, and strength. Notwithstanding all the difficulties attendant on a process new to most of the growers, and an ignorance of the practical manipulations on which so much depends, there can be no doubt that our wines justify every encouragement being afforded to the planting of vineyards.

Mr. Landor, in his work, *The Bushman*, says, "there is every reason to believe that Western Australia will one day become a great wine country. Its vineyards are becoming more numerous and extensive every year; and the wine produced in them is of a quality to lead us to believe that when the art of preparing it is better understood, it will be found of very superior quality. It will, however, be a new kind of wine; and, therefore, before it will be prized in Europe, prejudices in favour of older wines have to be overcome. Soil and climate combined, give to different wines their peculiar flavour. The vines which in Madeira produced the wine of that name, when brought to another country, even in a corresponding latitude, and planted in a soil that chemically approaches as closely as possible to that which they have left, will produce a wine materially different from that called Madeira. So with the vines of the Xeres and Oporto, of Teneriffe, or Constantia. Different countries produce wines peculiar to themselves; and the wines of Western Australia will be found to be entirely *sui generis*. All that I have tasted, though made from the poorest of grapes, the common sweet water, have one peculiarity; a good draught, instead of affecting the head or flushing the face, causes a most delightful glow to pervade the stomach, and it is of so comforting a nature, that the labourers in harvest prefer the home-made colonial wine to any other beverage. Every farm-settler is now adding a vineyard to his estate."

It is worth tracing back the early stages of grape culture and wine manufacture in the Australian colonies for present and future reference and comparison; thus at the meeting of the Hunter River Association, New South Wales, in 1849, Mr. Lang, of Dunmore, produced

five samples of wine, accompanied by an interesting report, which, however, is too long for insertion here at length. No. 1 was a red wine, of the vintage of 1846, made from the black cluster and red muscatel grapes, principally the former. This wine had a considerable flavour of the muscatel, but rather sharp; it was, however, pronounced by the judges to be sound, and free from acidity. No. 2 was a white wine, vintage 1847, made from the Schiraz grape exclusively; this was pronounced to be a pleasant and agreeable wine, of clear yellow colour and pure flavour, and very palatable; it was much approved, and much surprise was excited by Mr. Lang's description of the great produce of these vines this year, no less than 1,800 gallons per acre. No. 4 was a red Hermitage, vintage 1848, of which a sample had also been exhibited at the last November meeting; it had the Hermitage flavour, and was considered a good wine, but had not been allowed time to develop its qualities. No. 4 was a red wine, vintage 1848, made exclusively from the red muscatel grape; this sample had been but recently drawn from the cask; it was a thin wine, of pleasant but somewhat tart flavour; the general opinion drawn forth by it was that the muscatel was not a desirable wine grape, although it made excellent brandy. No. 5 was a white wine, vintage 1848, made from the Verdeilho and small Reisling grape; this sample had also been but recently drawn from the cask, but it was, nevertheless, a good wine, of fine flavour, and considered to be of great promise.

Mr. Carmichael, of Porphyry Point, produced three samples, one a red wine, of the vintage of 1848, made from the Pineau Noir grape; the wine was beautifully clear, and of a rich colour, rather tart in flavour, but a very good summer wine, and without any acidity. No. 2 was a white wine, vintage 1848, Shepherd's Reisling grape; it was of fine flavour, and of a rich golden hue. Mr. Windeyer, of Kinross, sent in a box of samples of three wines; one of which, labelled "black cluster," 1841, was a strong full-flavoured wine, pronounced to be quite sound, and of good body. A general opinion was expressed that the black cluster grape was one of the most valuable wine grapes in the colony. Samples, equally good, were sent in by Mr. King, of Irrawang. No. 1 was a red wine, of the vintage of 1846, made from the black Pineau and gray Pineau grapes, the former in much the largest proportion; this was a first-rate wine, and was by common consent so pronounced, and it was agreed that this wine would sell in the market as the best Burgundy wine, if it had a foreign name attached to it, although the colour was scarcely as deep as good Burgundy. No. 2 was a red wine, also of the vintage of 1846, and was made entirely from the Black Pineau grape; this wine was a deeper and richer colour than No. 1, and was pronounced by the connoisseurs present to be a better and fuller Burgundy wine, having the full flavour, colour, and body of the best Burgundy. Mr. Hickey's sample of brandy, although only ten days old, proved to be a very fine article of pale golden colour, and free from the fiery taste which usually marks the colonial brandy; Mr. Hickey said he could obtain about 180 gallons of such brandy from an acre of vines. Mr. Lang's brandy, distilled in 1848, was then tasted; it was of fine colour and flavour, somewhat fiery when pure, but very agreeable when mixed with cold water.

Sir Thomas Mitchell received the large silver medal offered by the Sydney Floricultural Society in 1849, for the best raisins. At their annual show there were only two sorts of wine exhibited, of which the judges reported as follows:—

"The Society having apportioned to wines the highest prize, in order to encourage the cultivation of the vine, and to bring into use generally the wines of the colony, regret to observe such slight competition.

"Only two samples of wine were exhibited, to the best of which (a white vine, made from the Verdeilho grape, of the vintage of 1848), was awarded the highest prize. At the same time the judges desire to remark, that the wine of the same class, of the vintage of 1849, possessed qualities which they have reason to believe would next year entitle it to rank with that which has now taken the prize."

There was published in 1856, in this *Journal* (vol. iv., p. 575), an interesting paper by Mr. James King, to whom the Society's silver medal was awarded, on the vineyards of New South Wales. As the subject is just now of even more interest, room may perhaps be found for the following further details.

It would be difficult to find a climate better adapted for the cultivation of the vine than that of New South Wales, or soils more suitable for it than those which everywhere abound upon its coast, particularly from Illawarra to Moreton Bay. The great elevation of much of the inland districts may not, perhaps, admit of such elevated portions producing wine, but they contain, nevertheless, many sites where vineyards would succeed, inferior in this respect as their climate is to that of the coast, if proper vines were selected. There are already many varieties in the Colony, some of which are suitable to cold and elevated sites, as proved by their successful cultivation in some of the best vineyards in Europe. What a source of enjoyment would the growth of the vine be to the inhabitants of Yass, Goulburn, Berrima, Bathurst, &c., did they but avail themselves of the natural advantages of those districts by growing wine for their own consumption. Wherever the climate is warm enough for the early or dwarf varieties of maize, wherever the peach or the fig ripen without the assistance of walls, there the situation would prove warm and sheltered enough to mature the fruit of the vine.

Site.—The best sites are the sides of gently-sloping hills, sufficiently elevated above the valleys or plains to be beyond the influence of hoar frosts in spring, and the chill humid exhalation occasionally prevalent in such situations. The first, not unfrequently in a single night, frustrates the hopes of the cultivator by cutting off the young shoots, and the last greatly retard the vintage. Experience in this branch of colonial husbandry shows that a vineyard on the side of a hill, at an elevation of one hundred to one hundred and fifty feet, will usually be three weeks or a month more advanced than vines of a like sort planted in a valley or plain at its foot.

Aspect.—The most favourable aspects for the vine in New South Wales, are those from east to north, and in the colder or more elevated regions, even round perhaps as far as north-west, but sheltered as much as possible by the ground or by thick wood from the south-south-east, round to the north-west. It is difficult to meet with a site comprehending every advantage, but the great object is to have the vineyard open to the full range of the meridian sun, without being exposed either to hot winds from west to north-west, nor to any of the strong land winds usually more or less prevalent in the spring. It is not advantageous, however, to have any sheltering wood within thirty or forty yards of the vineyard, unless it be a low hedge or shrubbery of moderate height.

Meteorological Influences.—The state and temperature of the atmosphere, at certain seasons of the year, are of great importance to the vine. In New South Wales, abundant rains during the latter part of the autumn and winter may be considered favourable, so also is occasional and moderate mild rain, until the fruit begins to swell to maturity. In the spring, as already said, the great evil to be guarded against is hoar-frost, which in low situations sometimes occurs late in the year, even in the neighbourhood of Sydney, but more frequently in the adjoining inland counties. The damage which these frosts occasion may be prevented in the following simple mode:—Small heaps of straw, rather damp, and mingled with a few shovels-full of loose earth, should be placed round the vineyard, at intervals of six or eight yards, and, if it be extensive, along some of the intersecting cart-ways. A dray-load of this short straw may be divided

into from twenty to thirty heaps. If the thermometer and the appearance of the weather overnight indicate the possibility of frost, a vigilant look-out should be commenced an hour or two after midnight. As soon as the thermometer approaches the freezing point, or falls a little below it, some heaps of the straw, say every sixth or eighth, should be lighted, and each so managed as to be kept mouldering for about an hour. The dense smoke produced is prevented from rising or dispersing by the weight of the atmosphere. As the straw burns out, fresh heaps should be lit, and care taken to reserve a sufficient number to occasion the densest smoke at sunrise and for an hour after. By adopting this precaution, the dew is prevented from freezing on the young shoots of the vine, or when frozen, they are not acted upon by the sun's rays, until thawed by the slowly-increasing warmth of the atmosphere.

With a little attention, the vine may, at no distant time, be extensively cultivated in Australia, and when that takes place, it will have a greater effect in inducing habits of sobriety than all the efforts of teetotal and temperance societies combined. Communities of vine growers are rarely intemperate in the use of fermented liquors, although, in the aggregate, they largely consume the produce of their own vineyards. Independently of this advantage, there can be no doubt that as soon as vineyards are extensively cultivated in Australia, vines will be produced rivalling the more famous growths of Europe, but until experience and skill have been acquired in the art, and the multiplied attention of individuals has been directed in this channel, it is not to be expected that wines should be produced of a quality sufficiently good for exportation. Considerable quantities of wine, and some of it of a superior kind, have already been made in New South Wales. Indeed, the ease with which the colonists generally may derive advantage from their own vineyards, is to be gathered from the fact that for some years past five and sometimes six individuals have been daily supplied at one estate in the colony with one pint of wine each, the produce of a single quarter acre of vines, forming part of an extensive vineyard. By the time these vines were in full bearing, they did not cost the sum of £15, including the original value of the land, and every outlay, with interest at ten per cent. The annual expense of cultivation, with the management of the vine included, did not exceed £5. Thus, for a sum not exceeding twenty-five shillings annually (less than one penny per day) may every colonist be daily supplied throughout the year with a sufficient quantity of sound wholesome wine. Of this description of wine, an acre of land in New South Wales will produce from 1,000 to 1,200 gallons, and about half the quantity of superior wine.

The following estimate of the profits of wine-making in New South Wales, was furnished me by a correspondent a few years ago:—

Expenses in making a Vineyard of 20 Acres in N. S. Wales.

	£
Clearing, stumping, and levelling 20 acres of forest-land, at £5 per acre	100
Trench-ploughing ditto	40
Fencing a 4-rail fence, and carting for ditto	40
Stakes for 50,000 plants, one to each plant, 5½ feet long	125
Planting cuttings, preparing and procuring them, driving in the props, and carting manure, if any is used	70
Cellar and premises to make and keep wine in	300
Tools, vats, horse and cart	50
Add expenses for two years after-planting, before the vines bear:—	
One gardener, or vine-dresser ...... £100; Eight labourers, at £30 each 240	340
Interest on the above outlay, at 10 per cent.	120
To cost at the end of two years	£1,185

If trenched with the spade, 30 inches deep, add £20 per cent. per acre more.

Annual Expense of Cultivating Twenty Acres, after the Second Year.

	£
One gardener or vine dresser	50
4 labourers all the year, including coopering...	170
Extra labour during vintage	50
50 new wine-pipes, at 30s. each (old ones will be procured for years at 7s. each)	75
Tear and wear of tools, apparatus, premises, &c.	20
Interest on outlay incurred during the first two years, at £10 per cent.	118
Annual expense	£483

Annual Returns from Twenty Acres.

Produce of 20 acres of vines, taking the average of all the vineyards in France, being 250 gallons per English acre, 5,000 gallons at 4s. per gallon, casks not charged	£1,000
Annual income	£1,000

This estimate shows a profit of upwards of a hundred per cent. on the culture of the vine in Australia.

"A Vine-grower" gives the following as the estimated cost of cultivating an acre of land for the growth of grapes:—

	£
Trenching and clearing	40
3,000 plants, at £2	6
To set 100 plants per day, 30 days, at 8s., without rations	12
To fence and rail an acre	51
Labour and management, £30 a-year, 3 years	90
Total	£199

After standing three years, this vineyard will produce 400 gallons wine, on an average 10s. per gallon—£200, and about £50 worth of grapes, leaving a profit of £51. The profit of the fourth year will increase to double, and average more every succeeding year.

Even in Victoria, with all its paramount gold digging attractions, and the turmoil of business and trading operations, the vine is making some little progress, for we learn from the statistics that in 1854, there were produced in a portion of the county Grant 9,100 gallons of wine, 100 gallons of brandy, and 80,580 lbs. of grapes were sold. In 1855, 6,000 gallons of wine were manufactures on Belperoud's vineyard, and about 2,000 gallons on Pettaval's, 200 gallons on a very small vineyard at Fyan's Ford, being upwards of 8,000 gallons from those vineyards only, but were Brequet's and other important vineyards calculated (so far as their wine produce is concerned) with the above-mentioned ones, a total of from 16,000 to 20,000 gallons might be set down as the year's return of native wine; and, great as the quantity appears this season, should the weather be propitious, which at present is the case, a great increase will be made in the number of gallons produced last year.

Sir W. Denison, when Governor of Van Diemen's Land, took some pains to obtain information calculated to be useful to the wine makers of the Australian colonies. From these hints, contributed by Mr. T. C. Banfield, and published in the *Hobart Town Government Gazette*, I take the following:—

One great source of expense attending the cultivation of the vine in Europe, is caused by the care required to make the grapes ripen. Even in the Tokay vineyards of Hungary, and in Italy as far south as Rome and Albano, the vines are cut low, are carefully staked, and cleared at stated times of the superabundant foliage which prevents the sun's rays from warming the ground in the ripening season. The reflected heat is used like that from a wall, and is more looked to than the direct

action of the sun's rays, under which the grapes often burn up.

A great deal of labour thus expended, together with the cost of staking, may doubtless be saved in warmer latitudes, where hands are not abundant, but the climate allows the grape to ripen without nursing. In such countries, fine wine, being a valuable exportable crop, is most desirable for the land-owners.

The average produce of an acre of grapes in Europe varies from 1 to 1½ pipes on the Rhine, to 2 and sometimes 2½ pipes in southern France, Hungary, and Italy.

The value of wine is not, however, inversely as the yield, since the finest Rhenish wines sell not unfrequently for £200 per pipe, while £50 to £70 is considered a high price for choice clarets, ports, and sherries. It is not an uncommon thing to have 25s. per bottle charged at a London tavern for Rhenish wine of superior but not of the best quality, which is at the rate of £760 per pipe. The consumption at this extravagant rate is, of course, limited; still, consumers are found, and this circumstance indicates how large a field is open to the industrious wine-grower.

The soil best suited to the growth of the vine has occupied a great deal of attention. The experience of Europe shows that the vine thrives in nearly every kind of soil, and that it is of more importance to choose a fresh broken soil than to select one of any particular composition.

In the following table, the nature of the leading vineyards is stated:—

NAME OF WINE.	COUNTRY.	ROCKY SUBSTRATUM.	SOIL.
Tokay	Hungary.	Volcanic.	Alluvial.
Auvergne	France.	Ditto.	Tufa and alluvial.
Lacryma Christi	Vesuvius.	Ditto.	Tufa.
Monte Pulciano...	Roman States.	Ditto.	Ditto.
Johannisberg ...	Rhine.	Clay-slate.	Alluvial.
Steinberg	Ditto.	Ditto.	Rock decomposed.
Hochheim... ...	Ditto.	Ditto.	Alluvial.
Port	Lower Douro.	Ditto.	Ditto.
Liebfrauenmilch	Rhine.	Alluvial.	Ditto.
Bordeaux	France.	Ditto.	Ditto.
Steinwein	Wurzburg, in Bavaria.	Red sandstone.	Rock decomposed.
Hardt	Rhenish Bavaria.	Ditto.	Ditto.

From the above list, it appears that a great variety of soils can yield superior wines; and we are by this circumstance confirmed in the notion that success depends more upon the treatment of the juice after it is obtained, than upon the soil on which the grape is raised.

The vine is a plant which very much exhausts the soil. It has a tap-root throwing out feeders at the side, which admit of its being nourished from manure buried at some distance from the plant. This circumstance is of great importance to the vine grower, in countries where land is not at a very high value, since it facilitates the use of the plough instead of the hand-hoe now employed to turn over the earth in the costly vineyards of Europe. The rows of vines are easily kept far enough apart to allow a bullock to draw several furrows between them, without injuring the vines. The furrows should be eight or ten inches deep, and one in the centre might be made still deeper, into which the manure should be thrown.

The vine ought not to be allowed to form too much wood, but should be cut annually, so as to leave but a few shoots on each stalk.

In many parts of the Rhine, staking in is altogether dispensed with, and the vines are trained as low standard bushes, resembling currants. By adopting this plan, much expense is saved to the planter.

The kind of grape to be selected is matter of experiment, and the number of sorts from which good wine is obtained is almost as great as the variety of soils. The highest priced wines upon the Rhine are made from a small white grape, called "Riesling," which is an abundant bearer, and has a fine flavour. The aroma of the Muscatel grape is more powerful in the fruit, but it is not so powerful in the press, nor is it so durable in the wine as the simple delicate flavour of the "Riesling." A large white grape produces delicious and powerful wine at Rudesheim, where it is said to have been perpetuated from Charlemagne's time.

The small black cluster grape, of Burgundy, is much in use upon the Rhine, in Hungary, and in Southern Europe generally. It is to be feared, however, that the French red wines are to a great extent artificially flavoured, for which purpose peach-leaves and kernels are much resorted to.

A large black grape, and also a white variety of the same kind, were much spread in Europe by the Emperor Probus, who exerted himself to improve the production of wine in the Roman Empire, with great success. The grape is found at Tokay, Malaga, Bronte, Lisbon, and Madeira.

By far the most important subject for the consideration of the wine-grower, is the proper fermentation of the juice obtained from the ripe grape.

Fermentation has several stages, as both the brewer and scientific wine-grower well know. According to the stage at which the process is arrested, the liquor obtained differs in nature; the two extremes being wine and vinegar.

The stages may be classed in the following order:—

1. Vinous fermentation.
2. Spirituous fermentation.
3. Acetous fermentation.

By fermentation in the first stage, a quantity of the sugar contained in the grape-juice combines with the oxygen of the atmosphere, and forms alcohol, which transformation is accompanied with an escape of carbonic acid gas, and a separation of the fibrous matter from the pure liquor,—the fibres, &c., forming what is called lees.

The difference between the vinous and the spirituous fermentation consists in the moderate degree of working which is required to make the wine. The wort should never ferment so strongly as to allow a rapid and violent escape of carbonic acid gas, otherwise both the flavour and alcohol escape with it, and the wine is left tasteless. A great deal of flavour can escape in this manner with comparatively little alcohol, and the wine may thus remain strong, but flavourless. This is the case in the greater part of Southern Europe; and hence the necessity for resorting to artificial flavours, which, although now managed with skill, are far inferior in every respect to the natural flavour of the grape.

A slow process is essential, therefore, to a perfect vinous fermentation. This must be ensured by the choice of a cool cellar, and by protecting the must from the too rapid action of the atmosphere.

There is no real difference between what we have called "spirituous fermentation" and distilling, except that, in distilling extraneous heat is applied to quicken the process, and drive off the alcohol, which is caught in

the receiver. In fermenting, the temperature of the mixture is raised, but the alcohol engendered is not immediately driven out. It has a tendency to escape with the carbonic acid gas, and in a warm room soon evaporates in an open vessel. When more alcohol has escaped than is necessary to preserve the sugar and other ingredients contained in the grape-juice, the third stage or acetous fermentation commences, and we obtain vinegar.

The wine-maker's attention should, therefore, be concentrated on the first stage, or that of the vinous fermentation. He must seek to preserve the flavour and the strength—and in so doing he will preserve a pleasant degree of sweetness.

The flavour in the grape lies in an essential oil, which is enveloped at the same time with the saccharine matter in the ripening berry, and which has its seat immediately under the skin. For this reason, the manner of bruising the grape is not a matter of indifference, and after many attempts to invent mills for crushing, the wine-growers have returned to the old method of treading; large leather boots, armed with nails, are kept for this purpose at most of the large wine establishments on the Rhine. The bruised grapes should be filled into horse-hair bags, when white wine is made, and placed in the presses, the juice flowing from which is immediately put into pipes or double pipes, standing on end, and furnished with a very simple and inexpensive apparatus, which ensures the preservation of both flavour and spirit, if the temperature of the cellar be kept moderate. This is no other than a small tin tube, $1\frac{1}{2}$ inches in diameter, inserted into the barrel, near the top, and projecting from it three inches, when it turns down about as much, offering the means of plunging it into a small bowl of water. The water absorbs the carbonic acid gas as it evolves, and discharges it, when charged to excess, into the atmosphere, without allowing any escape of flavour or of alcohol.

By this simple and inexpensive precaution, the finest and strongest wines may be made without any addition of brandy. But the process is rather slow. The wine may be racked off four times in the course of the first year, and twice in every succeeding year; but it is needless to keep it in casks furnished with the tube after the first racking, the proper time for which is indicated by the cessation of all escape of carbonic acid gas through the tube.

The process of ripening is one of slow fermentation carried on in the cask, which absorbs the carbonic acid gas, but likewise without injury to the flavour. The period when the wine can be sent to market or shipped, depends on a nice adjustment of the balance between the alcohol evolved, and the quantity of sugar contained in the wine. Of course, the balance is not established until alcohol enough is developed to preserve the other ingredients.

Wines in which this balance has been destroyed by loss of alcohol, in consequence of too rapid evaporation, must be brandied, to make them stand the voyage,—a process which is wholly unnecessary if the directions respecting the fermentation here given are punctually followed.

8, Winchester-street, S.W., Sept. 4.

SMALL PARCELS POST.

The Secretary has received the following communication from a Postmaster in one of our principal towns:—

Sir,—With reference to your letter of the 10th ult., enclosing a copy of the Report of the Committee of your Society upon a Parcel Post, I beg to say that I had already come to an independent conclusion in favour of such a project.

No doubt the introduction of parcels disturbs the natural action of the Post-office, which is intended for letters only. But inasmuch as we have always carried newspapers, which are nearly as awkward as closed parcels would be, we have not been entirely confined to letters. Newspapers, and the generality of book parcels, are not things of intrinsic value. The Post-office does not profess to carry parcels containing value. It allows such things, because they come under the denomination of letters. The Post-office, moreover, provides, by registration, for the security (to a certain extent) of such letters as the public wish to be secured. When a person comes to complain that a letter containing value is lost, our answer is that such things should not be sent. But if we invite the public to send such things the same answer cannot be made. We should not have induced the sender to trust the department with his parcel without taking reasonable means towards securing its safety. The question is,—whether we should not aggravate the great standing blot of the penny post by increasing the quantity of things worth stealing? I am inclined to think not. First, because the great majority of real losses are of coin —coin ineffectually concealed. If a parcel of four ounces can be sent for a penny, a parcel containing a sovereign need not be known from a sample of goods; and I can trust the Society of Arts for inventing light and strong boxes of various sizes for sending all sorts of lawful articles. In the next place we could separate to a great extent the letter post from the parcel post, so that a lost parcel would not be harder to trace than at present. Still, notwithstanding the inclination to favourable anticipations, it is not impossible that the present scandal, disorder, and expense may be increased. Now, it has struck me that a parcel post could be so constituted as not only adding to the public convenience, but as supplying the means by which the penny post might be relieved from the evils which the present partial and incidental transmission of parcels has entailed upon it. I should say, let us distinguish between letters and parcels. Let us say (for instance) that a parcel is a closed packet, not consisting of or containing paper only. The absence of other things, and especially coin, can be ascertained by perforating the letter, and even the seal, in suspected cases, with a very thin awl. Parcels (excepting bank notes in envelopes, posted as letters) would then be distinguished from things of no intrinsic value. What shall we do for their safe transit? Registration (which does not ensure absolute traceability) by giving and taking receipts is too cumbrous. But can we not adopt some system of check? The main use of registration consists in knowing the precise stage where the letter disappears. Few would attempt (and none could continue) to abstract parcels, if immunity from suspicion be narrowed to such a point. I think this might be accomplished by a more simple practice than that of registration. The officer who takes in parcels or unlocks the parcel box, might take and send an account of all parcels despatched, and the delivering office might keep a list of all parcels given out for delivery. It is unnecessary now to go more into detail. As this would add to the work, we must provide for the expense.

I find the tradesmen of this town would gladly give 6d. per pound to send parcels everywhere. It is said by your Committee that they can be profitably carried at 4d. per pound. Before this is decided upon, it should be remembered that the postage now paid on parcels will be lost to the Revenue. The report calculates on the Letter department paying as much as it does now. It will also be proper to ask whether, if a rural postman is overloaded with parcels, the rate of 4d. would pay for a supernumerary messenger? All that is now over his regular Post-office load, and not more than his strength, is profit to the Revenue. But is a halfpenny per pound (especially for a light load) enough to pay an extra messenger? Mind, I am not prepared to answer in the negative; I only raise the question. With town letter carriers, we should get a decided advantage over the present system. The letters would be delivered by one set of men, and the parcels by another. Letter-delivery in town suffers delay at present, from the packages with which the letter-carriers are loaded. A registered letter

too, is a very hindering thing. If letter-carriers had only common letters, they would get round their walks much quicker. The parcel carriers, with somewhat less speed, would take their parcels in light wheelbarrows, with covers that could be secured when left at the gate of a garden, in front of a terrace, &c. Then, again, with respect to the mail-cart service, those carts which carry London bags, might, in some cases, want two horses instead of one. But with cross-posts this would scarcely be the case in any instance, as they seldom carry heavy weights. I could exchange parcels with half this county, all the next, and part of another, without using the railway at all, and, I think, without any increase to the cart service.

Supposing, however, that the rate for transmission be fixed at 4d. per pound, I propose that 2d. be added to, and included in, the charge for each parcel, for the purpose of providing a check upon its exposure to loss. Let the charge be 3d. for the first quarter of a pound, and a penny for every additional quarter of a pound.

The following would give a simple and comprehensive table of the rates of inland postage:—

1. A closed packet or envelope, not containing nor consisting of paper only, 3d. for the first quarter of a pound, and 1d. more for every additional quarter of a pound, or fractional part of a quarter.

2. A closed packet or envelope, containing and consisting of paper only, if it does not weigh more than a quarter of a pound, may be sent for 2d., and if not more than half an ounce (I should prefer an ounce), it may be sent for 1d.

3. An open packet, containing paper only, may be sent at the rate of one penny for every quarter of a pound, or fractional part of a quarter of a pound it weighs.

It would be a very great thing if the Post-office robberies could be stopped. The advantages of the penny post are justly appreciated by the public, but I am often led to think that they are purchased at a high rate, when the number of artificial criminals which it has made is taken into account. I feel persuaded that the Society of Arts does not regard the conveniences of life as outweighing considerations of humanity, not to mention the credit of a public department, or the no inconsiderable amount of loss sustained by individuals of the general public. I am, &c.,

"A POSTMASTER."

DISINFECTION OF TOWNS, SEWAGE, AND SEWERS.

The following communication has been addressed by Dr. R. Angus Smith, F.R.S., to the editor of the *Practical Mechanics' Journal*, bearing upon the subject of his paper read before the Society last year:—*

I beg to send you a proposal by Mr. Alexander M'Dougall and myself, for the disinfection of the sewage matter of towns,—a subject to which public attention has lately been most strongly aroused by the arrival of hot weather. We deal, of course, with the chemical part of the question; and we know well that our plan produces complete disinfection, and not mere deodorisation, which, however, is either total or partial disinfection. We propose to apply the disinfecting material by allowing it to flow into a pipe which shall intersect all, or the chief sewers at their highest part. The sewers will in this way be disinfected throughout, and the towns, of course, will receive the benefit. We have other modes of completely disinfecting the streets and courts, by putting some of the material used in the water carts, for example. The whole system will produce an amount of purity not before seen in towns. We have already given our plans, perhaps not so fully as may be required for any one particular town, but in their general bearing, to the Town Council of Glasgow; and we understand that Mr. Bateman, the engineer, and Dr. Anderson the chemist, are requested to report upon them; but we have not been desired to give the gentlemen the results of our experience. This, however, will no doubt be arranged before a final report.

The proposals which have hitherto been made for dealing with sewage are chiefly of two kinds. The first removes the sewage as rapidly as possible on to the land in the vicinity of the town, and a system of manuring by irrigation is carried on without interruption through the year. The distribution of the sewage on the land is effected by various methods. The second operates upon the sewage after it has left the town, and converts the matters obtainable from it into a portable manure. Circumstances will determine where one or other of these processes may be adopted with advantage. We propose to deal with what is, in fact, the most urgent necessity of the case, and to add a provision to be adopted with either plan for preserving the air of towns from pollution by noxious emanations from putrid sewage. This we propose to accomplish by acting upon the sewage, so as to disinfect it in its passage through the town. Offensive effluvia from sewers have hitherto been dealt with mechanically; stench-traps and similar means of obviating the evil have been found imperfect and unsatisfactory in their result. They have proved to be an apparatus difficult to wield in sufficient force to make them a part of a perfect system. Our plan is to act upon the sewage as soon as it enters the sewers, by a continuous current of disinfecting material, so as both to remove its offensive smell and to arrest the further generation of noxious gases; the result will be that the atmosphere of the sewers themselves will be preserved in a state of comparative purity.

The substances we propose to apply are such as have been found to be efficient by extensive use, viz., sulphurous and carbolic or phenic acid. Hitherto we have used these substances in combination with lime and magnesia, and have found them remarkably efficient as a disinfecting powder—(Mr. M'Dougall's Disinfecting Powder).* In using them in cases where it is needful that a flow of water should receive no interruption, such as in a sewer, we do not propose to add the basis, or at least in very small quantity. The substances used are known to destroy noxious exhalations and to arrest decomposition. Our own experience with them has been so varied and extensive, that we have not the slightest doubt of their efficacy. We believe that science has not made known to us any other substances so well adapted for the purpose. The sanitary condition of towns is necessarily the first consideration—the economical application of the refuse, though secondary, is not unimportant; and on this ground also the materials we propose to use are the best that could be employed, as they preserve the substances to which they are applied unimpaired for the purpose of manure. In other words, the manure is kept pickled and ready for use, and after a long period is found to be undiminished in value. This follows from the fact that the decomposition of the sewage, and the exhalation of its valuable products, are prevented.

Those who advocate the precipitation of sewage and the manufacture of solid manure, will no doubt appreciate the advantages of this plan, as it delivers to them the sewage matter uninjured; and they will be able to obtain a much more favourable result than can be hoped for from sewage which has become putrescent, and consequently deteriorated.

The advocates of liquid manures will also appreciate the advantages resulting from this plan; they will obtain the manure in its fullest strength and in a scentless condition to apply to the land. Its use in irrigation will be

* See *Journal*, vol. v., p. 338.

* *Journal of the Society of Arts*, Vol. v., p. 333; *Practical Mechanics' Journal*, Vol. ix., p. 246.

as inoffensive as pure water, thus obviating one of the great objections to the system.

The greatest advantages of the plan we propose are to be found in the towns themselves, where disinfection will be almost universal, and, with reasonable care on the part of the inhabitants, putrescent sewage will be unknown. It certainly has been said by the advocates of the exclusive use of liquid manure, that when it is carried rapidly away it can give no offence, as it is put upon the land before it can be decomposed. It has not been our fortune to find manure so entirely free from odour, neither has our experience shown that it can be put upon land without giving offence, unless previously deodorised.

It is our opinion that 2lbs. of sulphurous acid and 1oz. of carbolic acid, will be sufficient to disinfect the excretions of 300 persons for one day. This will cost about a penny, and the cost for a city of 2½ millions of inhabitants will be about £12,675 per annum, or for every 100,000 inhabitants, £507.

The cost of the plant required at each station where the disinfectant is prepared, will be about £500. The services of a man and a boy will be sufficient; the number of stations required will depend much upon the contour of the site of the town, and will require the consideration of the engineer. The number for London will not be great, but the £12,675 includes the cost for the whole population. We believe that after the sewers have been thoroughly cleansed, a much smaller quantity than we have named will be sufficient for keeping them in a condition of comparative purity. It is ascertained that the disinfection is more easily accomplished when the fœces are acted upon at a very early stage. It will be economical to manufacture the disinfectant near to the highest part of the sewers; these we propose to connect with the vessels in which the solution is prepared, the regulation of the quantity being under the control of the attendant. There are many particulars connected with the manufacture and use of the disinfectant which it is unnecessary to introduce here; they have been obtained by extensive experience, are simple and of easy application.

We believe the following advantages will arise from the method proposed:—

I. The purification of the sewers and disinfection of the town. This is a proposal entirely new in dealing with sewers. No one, as far as we know, has previously attempted the prevention of smell in the sewers themselves. It has indeed been asserted that the sewage can be removed from the town so rapidly, that there is no time to allow of decomposition. Granting the possibility: How rare is the fact!

II. This system can be applied where precipitation is used. The disinfected sewage passing through the town will be preserved without loss of manurial ingredients. It can be precipitated as readily as if it had not been disinfected, and the product obtained will be of greater value and increased in quantity by the amount of matter preserved, when an unexceptionable method of precipitation is arrived at. The inconvenience of leaving large accumulations of putrid matter outside the town will be removed, as there will be no fear of putrid exhalations from the mass, or from the liquid whilst it flows through the drains, even if they should be left uncovered.

III. This system can be applied where precipitation is not employed. The disinfected sewage may be allowed to pass through peopled districts and properties, where the passage of putrid sewage would be highly objectionable. Under this system it may flow without giving offence to any one, and may be used in irrigation with greater advantage to the crops, and without in the slightest degree polluting the atmosphere. Experiments at Mr. Chamberlin's showed that liquid manure laid on the land caused a nuisance so great, that the neighbours resorted to legal proceedings for its removal; but when disinfected by the method proposed, no unpleasantness was perceptible.

IV. The expense of covered channels outside towns will be avoided. If, for example, the proposal of taking the sewage through Essex were adopted, a covered channel would be rendered unnecessary by this method, although indispensable without disinfection.

V. In cases where the sewage is discharged into a river, it will prevent putrid emanations from the surface of the water. This would remove one of the most obvious causes of offence for sewage, and would apply to the Thames at London.

VI. The expense for all London will probably be under £13,000 per annum,—a sum which can only be considered as trifling in comparison to the advantages to be obtained.

Manchester, August, 1858.

SILKWORM.

M. F. E. Guérin-Méneville has lately laid before the Academy of Sciences in Paris an account of a new Chinese silkworm, which he states is properly the *Bombyx Cynthia*, and which he distinguishes from the *Eria*, with which it has hitherto been confounded.* He says:—

"On the 5th of last July, I had the honour of presenting to the Academy some living butterflies of the new silkworm, which I had endeavoured, without success, to introduce into France last year, as well as some fertile eggs which they deposited. I now exhibit some caterpillars of this important silkworm, together with the first cocoons that I have obtained; and, with the permission of the Academy, I will read a short extract from a paper I have drawn up on the subject:—

"The result of my labours is that the silkworm of the *Aylanthus glandulosa* of Japan is the true *Bombyx Cynthia* of Drury (1773), represented for the first time by Daubenton the younger, in his coloured plates (1760 to 1765), and cultivated for ages past in China, where its silk forms the clothing of the whole population of some districts. Roxburgh (in 1804) believed that the *Eria* worm,† which is cultivated in the East Indies, belonged to the same species; and the confusion, which it has been impossible to set right for want of materials, has lasted up to the present time, so that everyone has called the *Bombyx Cynthia* the *Eria* worm, also named the *Arrindy-arria* in Hindostan, which is in reality a different species, and lives principally on the castor-oil plant, producing as many as seven generations in the year.

"From the experiments which I have made in the breeding of these worms, I am now able to point out differences in the caterpillars, in the cocoons, and in their habits, which enables me to distinguish them far better than can be done by the slight difference found in the moths, which would only have led observers to imagine they were simply local varieties of one and the same species. The products of those two worms are very nearly the same. The carded cocoons afford an excellent material from which, in China and Bengal, a very strong fabric is manufactured. 'In China,' says Father d'Incarville, 'these silkworms of the ash (he had supposed the *Aylanthus* to be an ash) are a source of riches. The silk which they produce is of the colour of unbleached linen, lasts double the time of other silk, and does not easily spot.‡ The material is common in China, where it is known by a name which distinguishes it from the ordinary silk and from the other wild worms.' Thus Father d'Incarville says:—'They make the *tsiao-kien* from that of caterpillars of the ash, &c.' In Hindostan,

* See *Journal*, Vol. ii., pp. 247, 263, 603, 835.

† *Transactions of the Society of Arts*, Vol. lii., p. 208.—Ed. *J. S. A.*

‡ "Clothes made of this wild silk are not injured by rain, dirt, nor oil."—Stan. Julien, *Resumé des principaux traités chinois, &c.*, p. 174.

the thread which is obtained from the castor-oil silkworms is not less useful and common. 'The fabric which is made of it is of a loose texture and coarse, but it lasts an incredible length of time,' says Roxburgh, in conformity with Atkinson, and this assertion is confirmed by the most recent accounts.

"It is clear that the introduction of the true *Bombyx Cynthia* from China is now accomplished, and it only remains to develop this new industry, which is simply a question of money. All that is required is to raise plantations of the *Aylanthus*, a tree which is extremely easy of growth on the very worst soils, to cover them with the cocoons in the spring which have been hatched in the month of May, leave them to eat the leaves, protecting them only from birds, guarding them by some invalid workmen, incapable of any harder employment, as is done in China. At the end of June the first harvest will take place, followed immediately by a second in August. The cocoons required for stock will remain without hatching till the following May, which is not the case with the castor-oil silkworm, which continues breeding all the winter, requiring either the castor-oil plant cultivated in the greenhouse or the teasel.

"I shall consider myself well repaid for my exertions, if my labours shall result in the establishment of a new industry, which shall render the use of silk as common in this country as in China."

ELECTRIC TELEGRAPH.

Marshal Vaillant, Minister of War, lately addressed a letter to the French Academy of Sciences, requesting their advice whether the passing of the wires of the electric telegraph in the neighbourhood of powder magazines might not become a source of danger.

The question was referred by the Academy to a committee of the following gentlemen:—Messrs. Becquerel, Regnault, Despretz de Senarmont, Marshal Vaillant, and Pouillet as reporter.

The committee has just presented the following report, which has been unanimously adopted by the Academy:—

"It may be taken as certain that the electric currents passing through the wires for the ordinary despatch of messages can in no way be the cause of accidents; for, supposing that the wires became broken from any cause whilst a message was passing, the small sparks which would take place at the point of rupture would be insufficient to set fire to any powder which might happen to be deposited even on the wires themselves or the supports.

"It is, however, otherwise as regards atmospheric electricity. Its action is often formidable, and it would be an imminent cause of danger to the powder magazines.

"If, for example, the lightning should strike the wire, it is probable that it would be fused for a certain distance and dispersed, and that incandescent globules driven to a distance by the explosion, might be carried still further by the force of the wind; besides, the loose ends of the wire in a state of combustion, and driven by the same causes, would not fail to describe large curves round these points, and carry fire to great distances.

"If this be a probability, or simple possibility only, it is not the less necessary to place the powder magazines out of the reach of such a danger."

After having considered the different precautions to which recourse might be had, the committee gives the following directions:—

"1st. To use subterranean wires for that portion of the line which passes at a distance less than 100 metres from the magazines.

"2nd. To lay the subterranean pipes for the wires at such a distance that they will be in no danger from the employment of the workmen either in laying the line or in repairing it.

"3rd. To fix one or more lightning conductors on poles 15 or 20 metres high in the neighbourhood of the subterranean pipes, so as to protect them throughout their whole length against any direct action of the lightning.

"We ask the Academy to approve of these regulations, which appear to us to afford sufficient security for the War Department without imposing too much on the telegraphs."

SOUTH KENSINGTON MUSEUM.

During the week ending 4th Sept., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,875; on Monday and Tuesday (free evenings), 5,289. On the three Students' days (admission to the public 6d.), 595; one Students' evening, Wednesday, 123. Total, 9,882. From the opening of the Museum, 581,440.

Home Correspondence.

EXHIBITION OF 1861.

Sir,—The Exhibition of 1861 should comprise under one roof, but in separate rooms, first, the marvels of art, and secondly the productions of industry.

The success of the Paris Exhibition was a good deal marred by having separate buildings.

An early decision as to where and when the Exhibition should be is most desirable, for we are now drawing towards the autumn of 1858.

I am, &c.,

PHILIP H. HOWARD.

EXHIBITION OF 1861.

Sir,—I am extremely sorry to find, from an extract in your *Journal* of Saturday last, that the idea of holding the proposed Exhibition of 1861 at Kensington Gore should be advocated in so respectable a journal as the *Builder*.* The inconvenience of the site of the Great Exhibition of 1851 was only partially counterbalanced by the entire novelty of the undertaking, and I believe that those who saw and considered the amount of inconvenience and loss, in time and money, that accrued to the public, from the want both of railway and river, were astonished beyond measure that so many people should have reached the Great Exhibition, and would not have the slightest hope that any subsequent Exhibition could possibly pay under such a drawback.

It is to be regretted that the writer in the *Builder* has not given some reasons for his preference for Kensington over Battersea, instead of resting upon the assertion that the site belonging to the Commissioners is "specially marked out" for the purpose. It seems to me that a preference in favour of the Crystal Palace at Sydenham would be equally forcible.

The place "specially marked out" for the Exhibition of 1861 is that which can be most conveniently reached by the masses. Now Battersea has the triple advantage of road, rail, and river; it is becoming well known to the people, and it is desirable that it should be still more so. Again, a large building, which could, after the Exhibition had terminated, be applied to purposes of instruction and amusement, or even only the latter, would be an immense boon in that quarter of the town; and if the Exhibition of 1861 should yield such a result alone, it would be worth all the time and trouble bestowed upon it.

There can be little doubt, I think, that the managers of another Great Exhibition must of necessity pursue a different course to that followed in 1851. Success must be achieved, in 1861, by appealing to general and not special aid, by dependence more on judgment and less on enthusiasm, in short, by rendering the Exhibition more

popular in its management, and more in accordance with the habits and ideas of the public.

The Society of Arts has the means of obtaining valuable evidence upon the question of site, by sending a circular to the various Literary and Mechanics' Institutions in the neighbourhood of London, requesting each of them to take the subject into consideration, and to report the result, with reasons for the same, to the Society.

The Exhibition of 1851 was a marvellous success—marvellous in more senses than one,—but from the very nature of the difference between a first and second Great Exhibition, the former will be of service to the latter quite as much in the way of warning as of example. This in no way diminishes the honour which belongs to the managers of the former; they had a most difficult, almost impossible, task to perform, and they achieved an extraordinary success; but I believe that the same men, or any other set of men following in their footsteps, could not possibly succeed in repeating the experiment. The managers of the proposed Exhibition of 1861 must not calculate upon that sort of power which forces its way through rocks and over mountains, but upon that more valuable, but less imposing, faculty which teaches how to avoid them; and it seems to me that the first rock a-head is foreshadowed in the recommendation of the *Builder* as regards the site of the proposed Exhibition. I am, &c.,

T. L. E.

MECHANICS' INSTITUTIONS.

Sir, — If Mechanics' Institutions are ever to accomplish the object for which they were designed, and prove the means of raising the moral and intellectual character of the people, they must receive a more general support from all classes of the community than it would seem has been accorded to them. It is true, that in many places there have been demonstrations of enthusiasm which appeared to leave no doubt of ample success, but unfortunately these ebullitions of popular feeling were too often of a spasmodic character, and from want of that continuous aid which can alone prove of real service, they failed in realising the anticipations which had been formed. On the other hand, it would be as well to guard against forming conclusions too hastily, and refraining from further efforts, because the first favourable promises have apparently been fruitless of results. It would be advisable also to bear in mind, that all the labour of conducting the affairs of an Institution should not be thrown too unsparingly on the willing few, but that each one should consider himself in some degree responsible for a success in which he has or ought to have an interest.

Amongst the topics which might advantageously be discussed on occasions of festive gatherings, to which I alluded in my last, not the least important is to show that all classes are directly concerned in the prosperous working of a Mechanics' Institution. To those who are of an age when knowledge can be best acquired, it ought not to be necessary to insist upon the incalculable advantages which they may gain by devoting their leisure hours to the improvement of their minds, of the many evils which they may thereby avoid, of the great and substantial rewards for their exertions which are placed within their reach, and the simple but expressive fact, that to the great majority there are no other means open to them by which so large an amount of good may be obtained. Though they may never rise out of the sphere in which they are moving, they will be wiser, better, and happier members within it, enjoying the self-consciousness of intelligence and that self-respect which ensures the respect of others.

There are many, however, to whom these arguments may not apply, and yet they are not exempt from the duty of supporting the Institution by their countenance and subscriptions, because every one, whatever may be his rank in life, has an interest in the social welfare of the community of which he forms a part. Increasing intelligence is ever accompanied by increasing resources, which materially contribute to the well-being of a town and add to the means of enjoyment of all. To tradesmen, therefore, a flourishing Institution is a boon of no mean value; and if their own demands upon it be confined to the use of the library and attendance upon the lectures, they will receive full value for their subscriptions, besides inducing many a young man to grow up into a respectable and useful member of society. The wealthier classes should need no argument to elicit their sympathies and secure that assistance which is of so much consequence, as the amount of subscriptions requred is in most cases too small to be any real object to them. By all classes, however, it should be remembered that there is no more effectual aid to the diminution of crime than a well ordered Mechanics' Institution. It removes many sources of temptation; to the idle it offers employment, to the ignorant it offers knowledge, and to aspiring youth a legitimate object of ambition.

Nor should such Institutions be without the cordial support of the ministers of religion, who can do so much by their influence if they have the will to exercise it. To whom can their exhortations to lead a new life be addressed with such a favourable prospect of receiving attention, as to the intelligent mind which has learnt to think in the Mechanics' Institution. If all that is desired could be accomplished, their ministrations would prove of far more effect than when, as is too often the case, the youthful mind, intent only on self-gratification, is insensible to the appeals which might have saved rash youth from many and irremediable follies.

Let me, therefore, once again press upon all the importance of active and sustained exertions to make Mechanics' Institutes throughout the country all that they ought to be. Much patience may have to be exercised before those for whom they are chiefly intended may be able to appreciate their advantages, but such an obstacle to their usefulness is the most convincing proof of their necessity. Hopeful perseverance will, however, be sure to be ultimately rewarded, and it is to this point that I would more earnestly direct the attention of those who feel discouraged by repeated failures. I could point to several instances where flourishing Institutions now bespeak the triumph of continually renewed efforts, and, I firmly believe that in every English community there is too much latent good sense for such exertions to be wholly without fruits. This truth should be borne in mind not only by managers of existing Institutes, but in places where they do not exist, so that ere long there should be no town or village in Great Britain without such a means of improving its population.

The Society of Arts has lent much valuable assistance, but more use should be made of the columns of its *Journal* to encourage the timid, to strengthen the weak, to inform the ignorant, and, by the interchange of experience, to give value to isolated efforts. Local committees, when they feel themselves in difficulty, should make their wants known to their fellow-labourers in the cause; and when they find that their exertions have been crowned with success, should stimulate others to follow the good example, by making known what they have done. By such means have many of the great interests of the country been raised to their present state of prosperity, and by such means may many of the Mechanics' Institutions be placed on a more satisfactory footing. Those throughout the kingdom should do the same as those in this great county do by the Yorkshire Union. Availing themselves of its organisation, they seek, by unity of action and interchange of experience, to enjoy those advantages which singly, and unaided by mutual support, were unattainable. If, therefore, the *Journal of the Society of Arts* be made not only a record of the proceedings of Institutions, which is too often detailed too briefly, but a medium for cor-

respondence seeking and imparting information, stating difficulties, and assisting to remove them, it may prove a more valuable assistance than it has hitherto done to the labours of local managers. To do this, however, they must look to themselves; they must ask for information when they need it, and their own labours must supply the materials from which Mechanics' Institutions are to be benefited, and their advantages made intelligible to the whole community.

As a concluding hint, let me strongly recommend punctuality in correspondence. When returns are asked for to furnish statistical tables, they should be supplied promptly and surely, and the Secretary of the Society of Arts not be allowed to state, as he has done before, that having sent out above a thousand circulars, he has not received a hundred and fifty replies.

I am, &c.,
BARNETT BLAKE.

Leeds.

Proceedings of Institutions.

BARNSLEY.—In the last report of the Mechanics' Institute and Literary Society, the Committee note an improvement in the financial position of the Institute, notwithstanding a slight decrease in the income from members' subscriptions and donations. The list of members during the past year shows an increase of 15 persons; but, owing to the late financial troubles, some members have left the town, and the subscriptions of others may be withdrawn. The news-room continues to be well-attended, and there is no increase in the cost of that department. The news-room and library have been re-painted during the year, and a new book-case added for the library. The total number of volumes is now 1,430, of which 47 have been purchased, and 40 received from various donors during last year. The circulation of books and periodicals presents only a net increase of 32 volumes; but there is a remarkable and gratifying change in the quality of the works taken out, there being a decrease of 894 volumes of Novels, &c., 154 periodicals, and an increase of 1,145 volumes in reading of a more solid character. The most satisfactory feature in the present balance-sheet is, however, the hall and lecture account, which exhibits a cost of £11 4s. 10d., in 1857, against £41 17s. 10d., in 1856. This large difference arises chiefly from the increased lettings of the hall to the public. The lecture fees are £9 8s. 1d. in excess of the same item for the previous year, to which extent the purchasers of lecture season-tickets and members have been benefited in the quality of the lectures. The following lectures were delivered during the season:—Mr. George Grossmith, of London. "A Humorous Lecture on Lecturing;" Mr. Walter Rowton, of London, on "Comic Literature: an Evening with Charles Dickens;" Mr. Ellis Roberts, of London, harpist, by appointment, to his Royal Highness the Prince of Wales, "A Musical Lecture," with illustrations on the harp, assisted with the vocal services of Miss Annie Cox; Mr. George Dawson, on "The Improvers of Shakspeare: their Principles, Practices, and Failures;" the Rev. E. Higginson, of Wakefield, on "Good Reading;" Mr. William Kidd, of London, on "Old Heads for Young Shoulders;" Mr. C. Charles, of London, on "Burlesque;" Mr. Hick, of Wakefield, on "The Arctic Regions, an Hour's Entertainment for the Young," illustrated by dissolving views; Miss Clara Seyton, of London, "A Musical Lecture, illustrative of English Comedy and Ballad Opera;" the Rev. R. Balgarnie, of Scarboro', on "Florence Nightingale;" Mr. Walter Montgomery, of Manchester, on "The Beauties of Shakspeare and other Poets." In addition to these, the members had free admission to two lectures on Palæontology, for which they were indebted to gentlemen in the town, members, and others, who privately subscribed the sum of £10 10s. for Mr. Hawkins's fees. To these gentlemen the thanks of the Committee are gratefully tendered. Another lecture on India, by the Rev. Canon Trevor, is also to be added to the list. The members of the Institute for the past year were as follows:—£1 annual subscribers, 6; 15s. ditto, 7; 10s. ditto, 201: 6s., ladies, 28; 6s., youths under 18, 30; 6s., country members, 11; total, 283.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Sept.* 3, 1858.]

Dated 22nd April, 1858.

890. P. E. Aimont, Paris—Imp. in railway indicating and signalling apparatuses.

Dated 20th July, 1858.

1636. R. Clarke, Cwmbran, near Newport, Monmouthshire—Imp. in windows, window blinds, and shutters.
1642. W. Asquith and J. Asquith, Leeds—Ornamenting the surfaces of raised pile fabrics, and in the apparatus employed therein.

Dated 24th July, 1858.

1668. W. Merry, 9, Park-place-villas, Paddington—Imp. in apparatus for preventing the escape of foul air from area, kitchen, and scullery drains of dwelling-houses, also from street, stable, and slaughter-house drains.

Dated 5th August, 1858.

1776. J. Luis, 1B, Welbeck-street, Cavendish-square—A new system of truss. (A com.)
1780. W. Moseley, 17 and 18, New street, Covent-garden, and W. S. Champness, Clapham—An improved self-filling reservoir penholder.
1782. J. Henderson, Lasswade, Mid-Lothian, N.B.—Imp. in machinery for weaving plain or figured fabrics.
1784. C. Mather, Salford Iron Works, Manchester—Imp. in shearing machines.
1786. W. Clay, Liverpool—An improved mode of manufacturing cast steel and wrought iron into ingots and other forms.
1788. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of lace. (A com.)

Dated 6th August, 1858.

1792. F. H. Stubbs, Leeds—An improved mode of communicating between the guard and engineman on locomotives or railway trains.
1794. S. Carey, Clink-street Wharf, Bankside, Southwark—An improved system of forming the permanent way of railroad transit, also common tramway, and channel or watercourse, by the means of cast-iron plates or boxes peculiarly constructed, so as to make one continuous way or channel.

Dated 7th August, 1858.

1796. G. P. Lock, Liverpool—Imp. in the composition of paints for coating iron ships, and for other useful purposes.
1798. J. Webster, Birmingham—A new or improved metallic alloy.
1802. J. Imray, 65, Bridge-road, Lambeth—Imp. in apparatus used in printing.
1804. J. Walker, Glasgow—Imp. in machinery or apparatus for moulding or shaping metals.
1806. A. V. Newton, 66, Chancery-lane—Imp. in pianofortes. (A com.)

Dated 9th August, 1858.

1808. J. J. Murphy, Belfast—Imp. in the construction of floating bodies, and in the means of supporting floating structures.
1810. H. Clayton, Atlas Works, Upper Park-place, Dorset-square—Imp. in machinery for manufacturing bricks and tiles, and other articles of brick, earth, clay, or other plastic material.
1812. T. G. Messenger, High-street, Loughborough—Imp. in the manufacture of garden engines, which are also applicable to fire or other engines.
1814. W. E. Newton, 66, Chancery-lane—An improved method of arranging and applying magnets to counteract or compensate for the effects of local attraction on the mariner's compass. (A com.)
1816. W. Spence, 50, Chancery-lane—The precipitation of purple colouring matter by chloride of calcium. (A com.)

Dated 10th August, 1858.

1818. A. Barchou, 49, St. Augustin's-road, Camden-town—Imp. in the mode of fastening the soles and heels of boots and shoes. (A com.)
1822. M. Moses, Portsdown-road, Maida-hill—Imp. applicable to umbrella and parasol sticks.
1826. R. C. Gist, 36, Cannon-street—Imp. in knitting machines. (A com.)
1828. J. G. Appold, Wilson-street, Finsbury-square—Imp. in the manufacture of wire ropes or cables.
1830. E. Tamberlick, Rue du Commerce, Quartier Leopold, Brussels—Imp. in apparatus used for exhibiting advertisements. (A com.)

Dated 12th August, 1858.

1832. W. Knowles, Bolton-le-Moors, Lancashire—Imp. in certain parts of machinery used in preparing and spinning cotton and other fibrous materials.
1834. G. Houghton, Birmingham—An imp. or imps. in saddles.
1838. R. Baxendale, Manchester—Imp. in brushes, mops, or apparatus for washing and cleaning.
1840. R. Jobson, Wordsley, Staffordshire—Imp. in apparatus used when making moulds for casting shells and other articles.
1842. R. Jobson, Wordsley, Staffordshire—Imp. in apparatus for supplying water to axletree boxes and other journal bearings to lubricate the same.
1844. R. Jobson, Wordsley, Staffordshire—Imp. in apparatus for crushing and sifting.

Dated 13th August, 1858.

1846. L. Autra, Wardour-street—Improved apparatuses for exhibiting advertisements.
1848. C. L. Light, Pall-mall East—Imp. in electric telegraph ropes or cables.
1850. J. Petrie, jun., Rochdale—Imp. in machinery or apparatus for stretching and drying woven fabrics.
1852. G. Schaub, Birmingham—New or improved machinery to be used in the manufacture of certain kinds of printing types, and also in the manufacture of spaces and quadrats used in setting up printing types.

Dated 14th August, 1858.

1860. S. C. Lister and J. Warburton, Manningham, Yorkshire—Imp. in dyeing wool, hair, cotton, flax, and similar materials, also yarns and textile fabrics made from such materials, also in dyeing and tanning other substances and materials, also in washing wool, and in discharging the gum from silk.

Dated 16th August, 1858.

1865. G. K. Geyelin, London—Folding bedsteads, and which he calls the Universal and Folding Joint for bedsteads.
1866. P. E. Chappuis, 69, Fleet street—Imp. in stereoscopes and stereoscopic apparatus.
1867. C. G. Cutchey, 15, Portland-cottages, Forest Hill—A railway danger-signal-whistle.
1868. L. A. Herrmann and E. I. E. Herrmann, Paris—Imp. in connecting together pipes, tubes, or ways for the conveyance of water or other fluid, and in means or apparatus for regulating the flow or discharge, and supply of such fluids, and in means or apparatus for facilitating the forming of such connections.
1869. A. V. Newton, 66, Chancery-lane—Certain imp. in machinery for forging horse-shoes. (A com.)

Dated 17th August, 1858.

1871. J. Webster, Birmingham—A new or improved projectile.
1872. W. E. Evans, Norfolk-street, Sheffield—Imp. in harmoniums, concertinas, organs, and other similar keyed instruments.
1873. J. Jackson and A. Fisher, Highfield Steel Works, Sheffield—An imp. in the manufacture of hats.
1874. G. Halkerston, Frenchie, Fife, N.B.—Imp. in mangles.
1875. J. Norton, Rosherville, Kent—Imp. in projectiles.
1876. F. Shaw, Siddals-road, Derby—Imp. in spindles for the spinning of silk and other fibrous material.
1877. G. Mills, 5, St George's-terrace, Queen's-road, Regent's-park—Imp. in machinery for cutting wood for staves.
1878. D. Lichtenstadt, Surrey-square, Old Kent-road, and C. Duff, Hill-street, Peckham—Imp. in treating tan and tanning refuse to obtain valuable products therefrom. (A com.)

Dated 18th August, 1858.

1879. J. Luis, 1B, Welbeck-street, Cavendish-square—A new safety system for preventing an accidental discharge in fire-arms. (A com.)
1881. W. Soelman, 3, Bennett-street, Middlesex—Additional imp. in the construction of propellers, chiefly with reference to my former patent, dated 20th August, 1855.
1882. T. Williams, Aberdaron, Carnarvon—An apparatus to be used for a churn or for a washing machine.
1883. R. Anderson, Black Braes, Stirling, N.B.—Imp. in stuffing boxes and packings.
1884. T. O. Duke, Kennington—Imp. in preparing cheques and such like documents, and in the means of preventing forgery or surreptitious alterations.

Dated 19th August, 1858.

1885. A. Pilbeam, 2, Lonsdale-place, Notting-hill—A bradawl screw.
1886. W. Hudson, Burnley, Lancashire, and C. Catlow, of Clithero, in the same county, for the invention of certain imp. in looms for weaving.
1887. W. F. Padwick, Hayling Island, Hants—A machine or implement to be employed on land sown with turnips, to protect them from the ravages of the fly, applicable also to the protection of other crops.
1888. J. C. Plomley, Maidstone—An imp. in joists and laths used for supporting hair and other pervious floors in oast-houses.
1889. M. F. J. Delfosse, Regent-street—Imp. in electro-magnetic machines.
1890. W. Smith, 18, Salisbury-street, Strand—Imp. in steam engines. (A com.)

Dated 20th August, 1858.

1891. W. Pearce, Bristol—Imp. in the manufacture of air-tight bottles, jars, or similar articles.
1892. W. A. Munn, Throwley House, near Feversham—An improved method of constructing railway carriages, whereby greater safety is insured in case of collision.
1893. F. Preston and W. McGregor, Manchester—Imp. in machinery for cutting files.
1894. H. Hood, Leeds Iron Works, Leeds—Imp. in the manufacture of railway tyre-bars, boiler plates, bar iron, and forgings.
1895. L. F. H. Droinet, Paris—Imp. in bearings and packings for rotating and reciprocating shafts, and joints of pipes, and other like purposes.
1896. P. Spence, Pendleton, Lancashire—Imp. in the manufacture of alum.
1897. J. L. Figgett, Missionary-place, Walworth—An improved construction of syringe or hand pump.
1898. W. Clay, Liverpool, and E. L. Benzon, Sheffield—Imp. in the manufacture of iron and steel.
1899. T. Knowles, Gomersal, Yorkshire—Imp. in looms for weaving. (A com.)

Dated 21st August, 1858.

1901. F. F. Delpy, Paris—Imp. or imps. in metallic stay busces.
1905. W. Henson, Saint Just, France—Imp. in circular looms, or knitting frames.
1907. R. Laming, Hayward's Heath, Sussex—Imp. in purifying gases and liquids, in preparing purifying liquids, and in apparatus for apportioning measuring liquids.

Dated 23rd August, 1858.

1909. F. Puls, Roxburgh-terrace, Haverstock-hill—Imp. in the distillation of coal.
1911. M. R. Pilon, United States—Imp. in the manufacture and construction of fire arms, and in means of loading the same.
1913. L. Higgins, Jersey City, and A. Brown, New York, America—Imp. in reefing the sails of navigable vessels.
1915. T. Averill, Birmingham—An imp. or imps. in mills for grinding. (A com.)
1917. J. H. Robinson, Clement's-court—An improved shirt.
1919. A. Rottmann, Lawrence-lane—Imp. in fastenings for bags, portemonnaies, pocket books, and similar articles. (A com.)

Dated 24th August, 1858.

1921. H. B. Barlow, Manchester—Imp. in self-acting lubricators. (A com.)
1923. H. Wilson, Watling-street—Imp. in the mounting of hand saws.
1925. J. Biggs, Leicester—Imp. in the manufacture of caps, resembling in form the Turkish fez.

Invention with Complete Specification Filed.

1971. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the supports of rails for railways. (A com.)—31st August, 1858.
1977. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the prevention of steam boiler explosions. (A com.)—31st August, 1858.

WEEKLY LIST OF PATENTS SEALED.

September 1st.

415. E. H. C. Monckton.
418. G. and J. Kirkley.
423. W. H. Graveley.
425. G. A. Biddell.
434. P. Moore.
399. H. G. Collins.
445. C. F. Parsons.
447. C. R. Moate.
451. J. S. Nibbs and J. Hinks.
452. Comte C. Cavalli de St. Germain.
455. E. Burke.
464. J. H. M. Maissiat.
467. T. Lyne.
472. W. Clark.
502. W. Pearson.
514. J. Jameson.
570. J. M. May.
990. W. H. Morrison.
1068. J. West.
1112. H. Walker.
1360. B. Atwater.

September 3rd.

484. W. Harding.
485. G. S. Andrews.
495. F. E. D. Hast.
497. J. Worrall and C. Race.
499. J. Warburton.
508. J. T. Coupier.

Patents on which the Stamp Duty of £50 has been Paid.

August 31st.

1975. F. C. Calvert.

September 2nd.

1988. W. H. Zahn.
2009. G. Collier.

September 3rd.

1995. C. and J. Clark.
1998. W. H. James.
1999. T. T. Coniam.
2011. J. H. Glassford.

Erratum.—In last week's *Journal*, for "2032. R. B. Feather," read "2232. F. C. Lepaye."

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address
4116	August 30.	Improved Braces	G. Barnes	9, New-court, Goswell-street.
4117	,, 30.	Church Hassock	A. Browse	Grove Villa, Compton, near Plymouth.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 17, 1858.

NOTICE TO INSTITUTIONS.

The Prizes and Certificates awarded at the Examinations held in May last, have been forwarded to the several Local Boards for distribution.

Copies of the Programme of Examinations for 1859 may be obtained on application to the Secretary of the Society of Arts.

COAL IN THE SOUTH-EASTERN PARTS OF ENGLAND.

The following is an abstract of a lecture delivered at the Royal Institution by Mr. R. Godwin-Austen, F.R.S. and G.S.:—

Fossil fuel may be of any geological age: seams and traces of it have often encouraged researches amongst the tertiary strata of the London basin; even within the last few years there has been a Woking Heath coal-mining adventure; and it has long been a matter of popular belief that Blackheath is to supply London with coal. There are, however, thick accumulations of tertiary fuel, of which Bovey, in South Devon, is the best example in this country. There is coal belonging to the period of the chalk—there have been innumerable trials for coal amongst the fresh-water formations of the Weald of Kent, Surrey, and Sussex—there is tolerable coal associated with the oolitic series of Yorkshire; but the coal to which the following speculations refer is that which is derived from what have been designated the "true coal measures."

The period to which this coal belongs in the earth's history is of very great antiquity; but the usual way of representing its age by reference to a vertical scale of geological formations, is inapplicable in the present case; and the only way in which it can be stated is this, that the whole series of formations which may be seen in the cliffs of the south coast of England, from Torbay to the Isle of Wight, have been accumulated since the period of the "true coal" series.

The superficial extent of the carboniferous series in this country is very great; allowing for what has been denuded, and what we know is covered up, it may be described as extending in a broad band from Berwick diagonally across the whole island into South Wales, and thence across the county of Devon.

The usual subdivision of the great carboniferous series into a descending series of "coal measures," "mountain limestone," and red sandstone, is geographical; the area of sandstone with coal plants is western; that of the limestone is central; and true coal measures occur unconnected with either. The carboniferous formation, as a whole, exceeds that of any other geological group in this country, considered with reference to surface.

What is coal? It is pure vegetable matter—the product of plant-growths. And with respect to the mode by which it has been accumulated, two theories have been proposed; there is the "drift" theory, which accounts for its occurrence as the accumulations of vegetable matter, brought down by mighty rivers, and deposited in lakes and sea-margins. There is something too turbulent in this theory to account for our great seams of fossil fuel.

The other theory is, that coal is the product of a vegetation which grew upon the very spots, and covered the areas over which our coal-beds extend, like the peat-beds of the present day. This is the theory of M. De Luc, M. Ad. Brongniart, and Messrs. Lindley and Hutton.

In supposing that coal originated as peat, all that is meant is, that it is the product of a vegetation composed of like plants, such as could live on in association over the same spots, growing above and decaying beneath; but differing as widely in the plants which composed it from our present peat plants, as did the whole of the vegetation of that period from that of the present period; the huge stigmariæ are wholly unlike any plants which commence the peat growth now.

The succession of a coal-field may be seen in a small scale in the deposits of lakes which have had differences of level from local accidents; and with reference to extent Ireland may be taken as an illustration of continuous masses of vegetable matter, of vast thickness, covering the whole country for 50 miles, and at low levels. Depress Ireland ever so little, so that the waters of the sea should reach in in some places, and the river waters, such as those of the Shannon, should collect into lakes; and just in proportion as the water was shallow would an uniform stratum of sand, or silt, or gravel, be spread out above the peat-growths.

The history of the coal-fields of this and every country, is that of an endless succession of such changes.

The question of the probable existence of coal measures at any given spot over the European area depends primarily on the original form of the surface of these coal growths; in other words, can we construct a map of Western Europe for the coal measure period?

The restoration of the physical features of a portion of the earth, for any given past period, is not so difficult, nor so purely speculative as some may imagine; every form and combination of mineral materials composing the sedimentary formations, all the forms of life they contain, serve to indicate the precise conditions under which they have been accumulated. Shingle and gravel mark marginal zones, sand zones mark lower or submarginal regions, deep sea deposits consist of mud or oaze; thousands of persons who have never even heard of the inquiries of the geologist, have doubtless argued that Blackheath, with its rounded shingle, must at some time or other have been at the sea-side. Assemblages of marine shells are the evidences of former seas; land and fresh-water shells and plants of old lakes and terrestrial conditions.

By the aid of such guides as these, the form of the area of the coal measures may be defined. Commencing in the west, we have early indications of the proximity of dry land and fresh-water accumulations. The earliest carboniferous deposits contain fern-like plants in wonderful profusion and beauty, with them are "pond muscles" (*anodon*). The land here lay to the south. The depositions of the North of Ireland require the existence of a wide expanse of dry land somewhere beyond it on the north. The Wicklow mountains were part of the dry land of the coal period. In the beds of the carboniferous limestone near Dublin may be seen angular fragments of the peculiar granite of these mountains, and which must have been floated away by seaweeds from a shore line, just as happens now. Dry land connected the Wicklow mountains with those of Wales. If we pass over this interval, we find evidence that the mountains of Wales were then dry land. The conditions of portions of the coal-measures bordering on this region have been investigated by most competent geologists, Sir R. Murchison and Mr. Prestwich. In the Shrewsbury district are pure fresh-water limestones. Coalbrook-dale, throughout the whole accumulation of its beds, seems to have been immediately subordinate to an area of dry land. The great Yorkshire coal series, which has been so well described by Professor Phillips, is wholly lacustrine, with the exception of one intercalated band of marine limestone.

The proximity of dry land to the Edinburgh coal-field

has been shown by the researches of Dr. Hilbert and Mr. L. Horner, in the fresh-water deposits of Burdie. The mountains of Cumberland were dry land, and so all those of the border counties which range from Wigtonshire to Berwick. All the mountains of the western highlands of Scotland, an area extending north beyond the Shetlands, and westwards into the Atlantic, was also land surface: a vast tract lay in this (the north) direction, of which the great Scandinavian chain alone remains, and which supported the rivers which bore down the waste of granitic and crystalline rocks which enter so largely into the coal-measure sandstones of our northern districts.

Passing across into the Cotentin, we find a series of coal formations, skirting the old mountain ranges of the north-west of France.

The great central granitic plateau of France is fringed with coal growths, and over the whole of its surface are innumerable small coal fields, the lacustrine accumulations of the valleys of that region—this was an upland coal region.

The Vosges mountains have been raised over a surface which was dry land, and was connected with the Schwartzwald, the Odenwald, and the Spessart, and a great tract extending north and east, whence came down that curious assemblage of terrestrial forms which has been met with in the great fluviatile and lacustrine deposits of the Saarbruch coal basin. Such is the form of the area which contains the great coal formations of western Europe.

The island which is represented in the interior of that great basin is not imaginary*; there is evidence of direction and extent of southern coast line from the shingle bed of Burnot. The extension of a band of shingle from beyond Eupen to the Boulonnais, marks the direction of an old coast line which lay to the north of it. It was from this mass of land that the terrestrial vegetation, and the fresh-water shells, so abundant in the Liege coal measures, were derived.

The whole area, as here described, may be compared, as to its physical characters, with large level tracts which lie west of the Blue Mountains in Australia, into which the Lachlan, the Darling, the Murrumbidgee, and the Murray discharge.

Between the close of the coal growths and the period of the formation which next succeeded, the surface of the whole of the area which has been sketched out was disturbed and broken up. Some of the lines, like that of our Pennine Chain, conform to those masses of terrestrial surface which tended in that direction; and a very remarkable line is one which has a general east and west direction across the European area. This line also conforms to the direction of old land which was to the north and south of it, and comprises the whole of the interval between the coal-growth surfaces of the Saarbruch districts and those of Belgium.

The section along the Meuse affords good illustrations of the character of this band of disturbed strata; in this section the upper beds of the coal measures occupy the deep troughs; the older parts of the Palæozoic series appear in the ridges. Such is the character of the great Liege, Namur, Mons, Valenciennes coal band throughout.

The line which passes along the south of this coal-band was a boundary for the oolite formations, and for the earliest accumulations of the cretaceous period. This is particularly well seen in the Boulonnais.

The question as to the probability of coal in this (south-east) part of England, depends on the relation between the physical configuration of the present surface as compared with this older surface.

The character of the axis or ridge of Artois, with its valleys of elevation, was described as a continuation of the line of disturbance along the south of the Mons coal band on the east, and as coinciding with the north escarpment of the Boulonnais on the west. The Boulonnais is physically a portion of the great elliptical denudation of Weald, of which the North Downs from Dover, west, are a continuation of the chalk range from Wissant, east. This line of disturbance is continued on by the valleys of elevation of High-clere, King's-clere, &c., and opens out into the valley of Devizes, forming a great linear anticlinal ridge, which coincides with the axis of old red sandstone of Frome, supporting the coal-fields of Somerset on the north.

The principle on which the existence of a band of coal-measures may be conjecturally placed along the south-east counties of England is this,—that like physical features have a like significance; the precise probability of the continuity of the coal band along our south-east area is great, and every fresh point of agreement adds strength to that probability; so that when these amount to three or four, the evidence may be deemed conclusive.

The Kentish-town artesian well passed through the white chalk and gault, a shingle brand of old sedimentary and crystalline rocks, ending on micaceous sandstones, at a high angle. Here the points of agreement with the French and Belgic sections were, 1st, the absence of the oolite series; 2nd, of the lower cretaceous strata; and 3rd, the occurrence of the tourtia or shingle brand, as in Flanders and the north of France.

The artesian well at Harwich found the chalk resting in old clay slate, with cleavage structure, and micaceous sandstones; and, from the presence of a Posidonia, may be referred to the culm series of the Rhenish provinces or of Devonshire; in this instance there is a perfect agreement with the condition of surfaces which extend north from the Belgian coal band.

By the help of these points, we can trace the arrangement of the old rocks beneath our south-east counties. The limiting boundary of the oolitic series, and of the lower green sand, lies south of London. The coal-trough conforms to the valley of the Thames and Kennet; older rocks still, such as those of the Belgian series, rise to the north; beyond which, at the distance of Harwich, the coal series is again brought in.

The existence of coal beneath Blackheath is therefore not so great an improbability as was once supposed; nor in the absence of the whole series of secondary formations, from the white chalk downwards, is its depth probably very great.

* The reference here made is to a map which represented the physical features of Western Europe, at the period of the coal growth.

ARSENIC IN PAPERHANGINGS.

The following letter, addressed to the editor of the *Daily News*, and published in that paper on the 13th inst., has been forwarded to the editor of the Society's *Journal* by Dr. Halley:—

Sir,—In your number for the 1st of the present month, which I have only just had an opportunity of perusing, there is a leading article on the above subject, in which allusion is made to a statement of mine, the validity of which you assert to have been controverted by the experiments and opinion of Mr. Phillips, the chemist to the Board of Inland Revenue. May I crave the indulgence of your space whilst I correct a misconception into which that gentleman has fallen, and at the same time vindicate the correctness of my own assertion.

The only communication that I have yet made upon this subject was that contained in a letter to the *Times* of the 11th January last, a letter hastily written on the spur of the moment, in reply to one by Mr. Fletcher, purposely condensed as much as possible, but containing a plain statement of facts as they occurred, with the simple view of warning others, and, if possible, to prevent the suffering I had myself undergone.

This letter was copied nearly entire into the number of the *Pharmaceutical Journal* for February last.

In the number of the *Journal of the Society of Arts* for the 27th August last, at page 606, Mr. Phillips, taking the report in the *Pharmaceutical Journal*, entirely misconceives, or at any rate misquotes, my statement, for he says: "It is stated that Dr. Halley, of Harley-street, had detected arsenious acid in the atmosphere of his study, the walls of which were covered with green paper, and that the test he employed was 'sheets of paper soaked in a solution of ammonio-nitrate of silver,' and that upon this paper were deposited numerous well-defined crystals of arsenious acid." This is not what I stated, and I am surprised that any chemist should place such a misconstruction upon the words I used. The merest tyro in chemistry should be perfectly aware that arsenious acid could not be so deposited. What I did state was this: "The air of the room was next carefully tested (by means of sheets of paper soaked in a solution of the ammonio-nitrate of silver, a very delicate test of arsenic), and distinct crystals of arsenious acid, visible under a low power with the microscope, and sufficiently well defined and numerous to preclude the possibility of mistake, were obtained on two repeated and separate occasions." In writing to a non-professional journal I did not enter into every step of an analysis of a purely chemical nature, but gave the results of the experiment, merely indicating between brackets the key to the means used, that any chemist curious in the matter might repeat the experiment, filling up, of course, the blanks left in the description of the process. The obtaining of arsenious acid crystals was a positive and conclusive result—the fact—terminating the whole experiment, the commencement of which was the suspension in my room of sheets of paper soaked in the solution of ammonio-nitrate of silver, which in their turn were submitted to reduction, and so on to the result, the process being that known as Reinsch's test.

But Mr. Phillips questions the fact of the crystals obtained being really those of arsenious acid; on the contrary, asserting that they were "more than probably" those of nitrate of silver. Without laying claim to any great knowledge of crystallography, which you assert is my presumption, it requires no great amount of acumen to distinguish between the decided octahedra of arsenious acid and the tabular plates of nitrate of silver, not to mention the impossibility of the resulting crystals in the experiment described being those of the latter substance.

Again, Mr. Phillips has misquoted my opinion as to the mode in which the arsenic is given off from the paper. I have not asserted, nor do I believe, that the arsenic contaminates the air in the form of arsenious acid. This is a very difficult point to determine, requiring more time and attention than I have had to spare from my professional avocations; but that, under certain circumstances, arsenic does contaminate the air of rooms covered with those papers to a most deleterious extent I firmly re-assert; and shall be most happy—I won't say to convince, but—to show Mr. Phillips or any other chemist interested in the point the results of the experiments alluded to, upon which this opinion is founded.

And now, sir, in regard to the counter-experiments of Mr. Phillips and others, I am not prepared to explain in what manner, in every instance, they have failed to obtain similar results. It is not easy from mere description to judge of an experiment involving minutiæ of manipulation; but knowing the quantities experimented with, and the very minute results I obtained—knowing also that those results would have been overlooked but for the use of the microscope, which Mr. Phillips, in common with many of his school, seems to disparage—I confess that his experiments, although, I have no doubt ably and apparently impartially conducted, have in no way shaken my confidence in those alluded to in my letter, conducted as they were with the kind and able assistance of Mr. Williams, of New Cavendish-street, a gentleman whose extensive experience as a wholesale manipulator is well known. The tests used were all prepared by him, and he kindly undertook many of the minutiæ of the analysis. It is however but fair to state that in several similar experiments I failed to obtain similar results—showing that it is not all arsenically coloured papers that give off the poison, and this may explain why some persons have not suffered from inhabiting rooms so papered; but, on the other hand, I re-assert, for I know from personal experience and from numerous instances to my own knowledge well authenticated, that many persons have suffered from this cause.

Apologising for the unavoidable length of this communication, I am, &c.,

ALEXANDER HALLEY, M.D.

7, Harley-street, Sept. 11, 1858.

The following is the passage in the article from the *Daily News* of the 1st inst., referred to above:—

The old proverb, that a "little knowledge is a dangerous thing," if not to its possessor at least to others, has been well exemplified by some recent chemical investigations. The progress of chemistry of late years has been so rapid that its most enthusiastic students have had hard work to keep pace with its advance. It has accomplished such marvels, and shown such usefulness in improving the manufacture of so many of the conveniences and even necessaries of every-day life, that we have all learnt to treat the opinion of the chemist at least with respect, if not with something approaching the most profound deference.

If the chemist is to retain that position, he can only secure it by the name not being usurped by those who really have no title to it. Those who do assume a knowledge of the science must also be careful not to step beyond the legitimate conclusions of their analysis, or substitute imagination or presumptuous assertion for demonstration.

In the evidence given by Dr. Alfred Swaine Taylor before the Committee of the House of Lords, on the "Sale of Poisons Bill," he alarmed their Lordships by describing the injurious effects of paper-hangings coloured with the arsenite of copper. Knowing the reputation of Dr. Taylor as a chemist, we have felt very uncomfortable since when sitting in any room covered with pretty green paper—especially if a gas-light has been burning. Our terror seems to have been partly shared by the Commissioners of the Inland Revenue Department. Their new offices had been hung with the poisonous paper, chosen no doubt for its refreshing colour. Instead of at once tearing down the obnoxious paper, they proceeded according to the customary rule of routine; their attention having been called to the circumstance they directed Mr. Phillips, the Chemist to the Board, to investigate the subject, and *report*.

The devotedness of the Commissioners is most admirable. We can fancy the conscious sense of martyrdom with which they sat environed with supposed arsenical atmosphere, while their chemist was preparing his Report. We knew not that we possessed a Board who would sacrifice their own health, rather than put the tax-payers to the expense of re-papering their offices. We congratulate them on the result of their officer's Report, and that they have now the pleasing assurance that their devotion has not filled their bones and livers with arsenic, to be produced by Professor Taylor, on some future *post-mortem*, for the edification of a coroner and his jury.

Mr. Phillips set about the investigation in a very proper and sensible manner. Two small closets were papered with the suspected covering. No ventilation was allowed, save that admitted round the chinks of the doors. The air was thus necessarily longer in contact with the paper than it would have been in an ordinary room. Both closets were carefully closed for 72 hours,

and in one a gaslight was kept burning 45 hours. The most delicate re-agents for testing the atmosphere of the closets were used without detecting the slightest trace of arsenic. It may be asked, then, how did these papers acquire so bad a name?

Last February a physician communicated to the *Pharmaceutical Journal* that he had detected arsenious acid in the atmosphere of his study, the walls of which were covered with green paper. The test he made use of for determining this fact was the hanging in his room "sheets of paper soaked in a solution of ammonia and nitrate of silver." After a time he found the paper covered with numerous well-defined crystals of arsenious acid, visible under a low power with the microscope. Mr. Phillips hung paper similarly prepared in his experimental closets. His paper was covered with crystals, but analysis proved these crystals to be composed of nitrate of silver, derived from the solution in which it had been dipped. Mr. Phillips therefore assumes, and we think with perfect justice, that if the learned Physician had trusted less to his presumed knowledge of crystallography, and tested his crystals, instead of jumping at the conclusion that they were composed of arsenic, he would have found them nothing more than nitrate of silver.

It may be some consolation for those of our readers who inhabit rooms papered with pretty green patterns, to learn that Mr. Phillips and his family have occupied a sitting-room covered with a paper heavily laden with arsenite of copper, for three years, without experiencing the slightest ill effect, though his bed-room during the whole time was papered with arsenical hangings. This is not, however, the principal reason why we have noticed Mr. Phillips's admirable Report. It is, we conceive, of the greatest importance that the public should be put on their guard against the too easy reception of assumed chemical conclusions.

We have no doubt of the perfect good faith of the physician who called the attention of the public to his presumed discovery. He did so from a praiseworthy motive. But we hope the exposure of his defective analysis will caution others from intruding their imperfect determinations on the public, to the serious detriment, it may be, of their honest neighbours.

The following letter, in reply to Dr. Halley, appears in the same journal for the 14th inst.:—

To the Editor of the Daily News.

Sir,—Dr. Halley has endeavoured to show, that in your leading article on the hasty conclusions formed by some chemists you have done him an injustice. He believes that you have been misled by the report of Mr. Phillips, the chemist to the Board of Inland Revenue.

Now, sir, I do not believe that you have been misled in the slightest particular, or done any injustice to Dr. Halley. What are his own statements in defence of his analysis? He says that he tested the air of the room covered with arsenical dyed paper by means of sheets of paper soaked in a solution of the ammonio-nitrate of silver, that these sheets of paper, after exposure, were reduced, submitted to a test know by the name of reinsch, and that by this means he obtained crystals sufficiently large to be seen under a low power of the microscope.

Because these crystals were decided octahedra, he maintained that they were crystals of arsenious acid. You, sir, complain, and so do I, that because Dr. Halley saw crystals of the form assumed by arsenious acid under certain circumstances, he jumped at the conclusion that the form of the crystal was a sufficient evidence to identify the substance. Now, sir, I have devoted a little attention to the subject of crystallography, and I therefore know that there are a vast number of substances besides arsenious acid which will crystallise as regular octahedrons. Dr. Halley had paper soaked in a combination of ammonia, silver, and nitric acid. He submits this paper, after its exposure to an atmosphere contaminated by gas, to certain tests. The paper had therefore, in all probability, absorbed the element sulphur, either in a simple state or combined with certain gases. Can Dr. Halley, therefore, take upon himself to assert, that the octahedral crystals could not have been formed from certain chemical combinations made during his experiments, which may not have contained a single particle of arsenic or arsenious acid? Is he sure that these octahedra were not crystals of sal ammoniac?

His sheets of test paper contained ammonia, the paper itself was probably not free from the chlorine it had absorbed in its manufacture. Is it not therefore as probable that the crystals he saw under his microscope were a combination of chlorine and ammonia, which will assume the form of a perfect octahedron, as that they were formed from a combination of arsenic and oxygen derived from the atmosphere? Which is more probable? That the crystals were formed from the combination of substances existing in the paper, or from the combination of substances supposed to be derived from the atmosphere. But taking into consideration the known impurities of the atmosphere, these might have combined with some of the ingredients contained in or introduced into the paper, so as to form combinations, known to crystallise in the form of the regular octahedron.

For any evidence Dr. Halley has given us to the contrary, he may have actually produced diamonds without being aware of his valuable discovery. Both his paper and the atmosphere contained carbon. The diamond, as pure carbon, assumes frequently the form of the perfect octahedron, in its crystals. If form be a certain test as to chemical composition, what evidence had Dr. Halley adduced that his so-called crystals of arsenious acid may not have been microscopic diamonds?

Dr. Halley admits that he was satisfied that because he saw crystals which he assumed to be perfect octahedra, these crystals were necessarily composed of arsenious acid, because he suspected the presence of arsenic in the atmosphere. It is of his rash conclusion that Mr. Phillips complains. He examines the atmosphere of a room, far more likely to be impregnated with arsenic than that examined by Dr. Halley, without discovering the slightest trace of that deleterious substance. Mr. Phillips is a chemist, Dr. Halley a microscopist. Dr. Halley gets a friend to manipulate the chemical part of his tests for him. Trusting to the deceptive form of his crystals, he neglects to submit these crystals to any test but this form. That form belongs to a host of substances besides arsenious acid; therefore Dr. Halley's ambiguous result cannot be taken as any confutation of Mr. Phillips's analysis.

Dr. Halley wrote his account of his experiments so vaguely as to lead Mr. Phillips to infer, as one reasonably might have done, that the microscopical crystals were deposited on the surface of the test papers. Mr. Phillips found his paper covered with crystals of nitrate of silver; he, therefore, hazarded the opinion that Dr. Halley's crystals, if tested, would probably have been found to be simply nitrate of silver. To this Dr. Halley replies, that it requires no great amount of acumen to distinguish between the decided octahedra of arsenious acid, and the tabular plates of nitrate of silver. If Dr. Halley will consult Phillips's translation of the Pharmacopœia, which I have no doubt he possesses, he will see there that the author of that work states that the octahedral faces of crystals of the nitrate of silver sometimes are so enlarged as nearly to obliterate the rhombic faces. It would require a very delicate eye to distinguish the octahedra of nitrate of silver, with their upper and lower angles replaced by a plane, from the regular octahedra of arsenious acid, with their upper and lower angles replaced, as they frequently are, by planes of the cube.

Without actual goniometrical measurement, it is extremely difficult to distinguish the regular octahedron

from some of the octahedra of both the square prismatic and the rhombic systems.

I would recommend Dr. Halley to repeat his experiments, and when he has obtained his octahedra, to submit them to such chemical tests as may satisfactorily determine their substance. Till he does so, he has no answer to Mr. Phillips's tests, nor will his negative crystalline evidence satisfy a

CRYSTALLOGRAPHER.

THE BAROMETER.

In the First Report of the Committee of the House of Commons on Shipwrecks (1843), will be found the evidence of Captain (now Admiral) Fitzroy, suggesting the importance of the barometer, not only on board ship, but on land on the coasts, as a guide for men having the charge of ships and fishing vessels. Admiral Fitzroy says:—

"I think that a neglect of the use of the barometer has led to the loss of many ships. From a want of attention to the barometer, they have either closed the land (if at sea), or have put to sea (being in harbour in safety) at improper times, and in consequence of such want of precaution the ships have been lost, owing to bad weather coming on suddenly, which might have been avoided had proper attention been paid to that very simple instrument. While alluding to the use of barometers, I may remark, that if such weather-glasses were put in charge of the Coast guard at the principal stations round the coast, so placed as to allow any one passing by to look at them, they might be the means, not only of preventing ships from going to sea just before bad weather was coming on, but of preventing the great losses of life which take place every year on our coasts (particularly in the Orkney Islands and on the coasts of Scotland and Ireland), owing to fishing vessels and boats going to sea when bad weather is impending. No bad weather ever comes on our coasts without timely warning being given by the barometer. The oldest seamen are often deceived by the look of the weather, but there is no instance on record of very bad weather, such as would have involved loss of life to the extent we have heard of in several years, having come on without the barometer having given timely warning. By the very small expense of an establishment of barometers, so placed as to be accessible to any fishermen, boatmen, or others on the coasts, much loss of life, as well as loss of boats, and even shipping, might be prevented.

"What state of the barometer indicates danger? It varies in different climates according to the range. The range is small between the tropics, but very large in the higher latitudes. In our climate the range is usually about two inches. The barometer falling considerably below its average height is at once an indication that some considerable change is going to take place, and when it falls low, as for instance (in our climate) to near 29 inches, or below 29 inches, a gale is certain to follow.

"Are the Committee to understand that you are of opinion that every ship ought to have a barometer on board?—I think that every ship ought to have either a barometer or sympiesometer, which is an efficient substitute for a barometer.

"Does the barometer show a sudden change of wind as well as the coming on of bad weather? Supposing a gale of wind is blowing, and you are sailing with a fair wind, does the barometer show any change of wind?—Decidedly.

"Supposing the wind was at west-north-west, and it shifted suddenly to west-south-west, would the barometer indicate that?—It requires some practice to be able to say *exactly what is likely to take place* after a change in the barometer; but the principal point for a seaman is, that no violent wind will blow without the barometer giving warning. He may not know exactly from what quarter the wind will come, but no strong wind will come on without warning being given.

"You recommend that at the Coast-guard stations there should be a barometer, by means of which people would know when a violent wind was coming on; but as it would not indicate the quarter from which it was coming, would you have the merchant ship always remain in port till the barometer showed fine weather?—Being accustomed to the barometer on our coast, one could tell from what quarter the wind would probably come by the height of the barometer, taken in connexion with its previous height, and the state of the weather, and the strength of winds that had prevailed before. Taking the state of the barometer in connexion with the appearance of the weather one could make a satisfactory conclusion as to to the quarter from which any violent wind would come. And the barometer, after very little practice, can be used by any man. There is no difficulty in using it sufficiently to know that danger is coming on; and if danger is coming on, a man refrains, of course from exposing himself to it; the quarter from which the wind comes being of minor consequenee.

"With a north-easterly wind, in this part of the world, the barometer stands, on an average, about half-an-inch higher than with the same strength of wind from the south-westward. All over the world there is a similar difference proportionate to the range of the mercury, for which allowance should always be made in considering the height of the barometer."*

In the first number of the Meteorological Papers, published by the Board of Trade, 1857, is the following passage respecting the use of weather-glasses:—

"The variety of interesting and useful, if not always important, subjects included within the range of meteorology, is not perhaps sufficiently realised in the minds of active participators in the world's stirring work. Irrespective of any scientific object, how much utility is there to all classes in what is commonly called 'weather wisdom?' In our variable climate, with a maritime population, numbers of small vessels, and especially fishing boats, how much life and property is risked unnecessarily by every unforseen storm? Even animals, birds, and insects have a presaging instinct, perhaps a bodily feeling, that warns them; but man often neglects his perceptive and reasoning powers; neither himself observes, nor attends to the observations of others, unless special inclination or circumstances stimulate attention to the subject. Agriculturists, it is true, use weather glasses; the sportsman knows their value for indicating a good or bad scenting day; but the coasting vessel puts to sea, the Shetland fisherman casts his nets, without the benefit of such a monitor, and perhaps without the weather wisdom which only a few possess, and cannot transfer to others.

"Difficult as it is to foretell weather accurately, much useful foresight may be acquired by combining the indications of instruments (such as the barometer, thermometer, and hygrometer) with atmospheric appearances. What is more varying than the aspect of the sky? Colour, tint of clouds, their soft or hard look, their outline, size, height, direction, all vary rapidly, yet each is significant. There is a peculiar aspect of the clouds before and during westerly winds which differs from that which they have previous to and during easterly winds, which is one only of the many curious facts connected with the differing natures of easterly and westerly currents of air throughout the world, which remain unchanged, whether they blow from sea to land, or the reverse.†

"Perhaps some of those who make much use of instruments rather undervalue popular knowledge, and are

* In south latitude the south wind corresponds to our north wind in nature and effects. The easterly and westerly winds retain their respective peculiarities in both hemispheres.

† Exclusive of local land and sea breezes of hot climates.

reluctant to admit that a 'wise saw' may be valuable as well as a 'modern instance;' while less informed persons who use weather-glasses unskilfully, too often draw from them erroneous conclusions, and then blame the barometer.

"Not only are reliable weather-glasses required at the smaller outlying ports and fishing places, but plain, easy, intelligible directions for using them should be accessible to the seafaring population, so that the masters of small vessels, and fishermen, might be forewarned of coming changes in time to prepare for them, and thus become instrumental in saving much property and many lives."

The works of Humboldt, Herschel, Dové, Sabine, Reid, Redfield, Espy, and others, confirm these views.

Acting on the foregoing views the Board of Trade have, during the past year, sanctioned (by way of experiment) some assistance being given by government to enable poor fishermen, and those employed on the more exposed shores of the British Islands (when unable to afford the expense themselves), to benefit by the use of weather glasses.

Ten substantial barometers, strongly made, durable, and easy to observe, have been already located as experimental loans at the following fishing stations:—Newhaven, Anstruther, Arbroath, Rosehearty, Whitehills, Port Easy (Portessie), Lybster, Dunheath, and St. Ives (Cornwall). Another will be placed in Mounts Bay. The Scotch Fishery Board have aided in this matter. Full instructions for observing and using the instruments have accompanied them to each place.

In the west of England; on the east coast of England; on the north-west coasts of Ireland and Scotland, and in the Shetland Islands, there is much need of such instruments.

Disasters and loss of life among the fishing population of our coasts, more especially in Banffshire, Lerwick, and Innishowen, have been narrated in the public prints. Many of these calamities might have been avoided by the judicious use of weather-glasses.

The Board of Trade have published a manual of instructions for the use of barometers and thermometers as weather-glasses, in two forms, one for fishermen and coasters, the other for young officers at sea.*

LIQUID MANURE.

The following is extracted from an article "On the Manuring of Grass Land," contributed by the Rev. W. R. Bowditch, of Wakefield, to the last number of the *Journal of the Royal Agricultural Society*:—

"The omission of sewage would render this paper culpably incomplete, and yet the application of sewage even to grass must ever be limited. The excessive quantity of water which must be put on in order to obtain sufficient fertilizing matter is so large, that the prudent and profitable application appears to me to be restricted to localities where it can be got on the land by the force of gravity, and where the soil is so porous and sloping as to allow a rapid removal of the excess of water. Moreover the grass grown by sewage requires to be frequently mown to prevent rotting, and therefore soiling seems the correlative of sewage manuring. That soiling will pay on a large scale, except for the production of milk and butter remains to be proved, and if it do not pay there is an end of the matter. Farmers and landowners cannot afford to sacrifice their incomes to crotchets, nor, in our densely peopled country, can we spare the produce of a single acre of available land. The Craigentinny meadows, near Edinburgh, afford a splendid instance of success due entirely to a judicious application of sewage, and wherever the same conditions obtain sewage should be applied in like manner. A ready and cheap vend for dairy produce, the means of applying the sewage by gravity, or at most by one pumping (as on some of the Edinburgh land), without any outlay for costly apparatus of distribution, and above all porosity and declivity of soil adequate for the removal of surplus water, are conditions to be fulfilled before a reasonable expectation of profit can be entertained. Where these meet, the farmer will do well to try a few acres, and extend his breadth of sewage irrigation accordingly as he finds it pay. It is far better that the sewage of towns should run to waste into the ocean, than that our cultivators should apply it to the land and lose money by the application.

"Of course I know what imaginative theorists will say to this, but after reading all their arguments (and sophisms too), and weighing against them the sober truths of experience and analysis, I can come to no other conclusion.

"But may not the farmer irrigate with his own home-made liquid manure? Where he has command of water and can do it without a constant charge for labour he may, but otherwise I entirely concur in the sentiment of one of our leading agriculturists: 'I am more and more averse to liquid manure: the labour is endless.'

"Let the liquid manure be mixed with soil, finely sifted ashes, and such other material as the farmer can command, and the compost applied liberally to the grass of the farm, and the profit thus derived will far exceed that to be made by the costly plans which have recently been proposed for adoption.

"I must observe, however, that the most prolific source of grass manure is human excreta, now expensively wasted in town sewage. Large sums of money are now expended to enable us to waste what may be economised with advantage in every way. The present absurd water-carriage of excreta must be abandoned, and sewers employed for their legitimate purpose, viz., to carry away waste water to its natural receptacle, the river. Moveable boxes should be attached to every house, and removed weekly in summer, fortnightly in winter. A cistern filled with dry pounded clay would be placed overhead, and a simple mechanical contrivance would throw down a measured quantity of this every time the handle was raised as water is now let down a closet. Nature's deodorizer and disinfectant would prevent the escape of injurious exhalations, and the refuse would be removed by water or other carriage some miles into the country, to await under sheds the farmer's season of use. This manure could be screened and applied by distributors, and would produce crops of grass which experience alone will enable us to estimate. Every element of grass is contained in this manure in large abundance, and while its preparation formed a sanitary improvement of much value to towns, its use would be a boon of enormous value to the country."

BISCUIT FODDER.

The following is extracted from the *Morning Post*:—

This is the name given by M. Naudin, a veterinary surgeon of the Imperial Guard, to a preparation of his invention, which has already been successfully tried in some cavalry barracks, and would seem, besides other advantages, to solve the problem which at present engrosses the attention of the agricultural world, viz., a sufficient supply of fodder for cattle in times of scarcity occasioned by drought. This biscuit fodder is composed of all kinds of substances generally given to horses and cattle, such as straw, hay, clover, oats, barley, peas, &c. To these may be added many others, such as the refuse of the wine-press, the pulp of various roots, the stalks of millet and maize, the leaves of the vine, the beetroot, and of certain trees, the sweepings of the barn and hay-loft, which contain a vast quantity of nutritious matter in the flowers and seeds of hay which are generally thrown away, &c. All these ingredients are bruised and

* These may be purchased, 6d. each, of J. D. Potter, 31, Poultry.

chopped together; a mucilage of barley-flour is then added, with a little salt, and the mixture is then left to itself for a few hours until a slight fermentation has set in, when it is put into square moulds, made into cakes, and left to dry in a current of warm air. In this state it may be preserved for a great length of time. When it is to be used, it is moistened with about one-fifth of its weight of water; each cake is broken into seven or eight bits, and put into the manger or nosebag, as the case may be. The cakes should weigh about a pound each; 20 cakes of that weight are sufficient for the daily ration of a horse. The advantages which this preparation offers are evident; mastication and digestion are rendered easier, and therefore the general health of the animal ensured. A sufficiency of fodder can be laid in store for the winter; the rearing of cattle need not be checked for want of food, and the waste occasioned by the animals themselves while they eat at the manger, letting half their allowance fall on the floor of the stable, is obviated. The hackney-coach horse, which eats its hay at the stand, often soiled with mud and filth, will find in the biscuit fodder a clean and wholesome aliment; horses conveyed on railways, and especially on board ship, can be easily fed, the stowage of a sufficient quantity of these cakes for a long voyage taking up but little space, while all danger of fire and spontaneous combustion, of so frequent occurrence in hay lofts, is completely obviated. Lastly, these cakes may be used as convenient vehicles for any kind of drugs which it might be necessary to administer.

SILKWORM (*AYLANTHUS GLANDULOSA*).

The *Aylanthus Glandulosa*, on which the new silkworm lately introduced into France by M. Guérin Menneville, feeds, as recorded in last week's *Journal*, p. 630, grows readily in our English gardens, though it has not yet acquired an English name. It is frequently found on the continent among the Boulevard trees, for which its fine appearance and fast growth render it suitable. Its flowers, however, smell abominably, but luckily they last only a short time. It is of Chinese or rather Japanese origin. The French give it the name of "Vernis du Japon," under a mistaken idea that the tree produces varnish. This, however, is not the case. Varnish is obtained from a plant something like it, but in reality altogether different—a sort of "Rhus" or "Sumach."

SOUTH KENSINGTON MUSEUM.

During the week ending 11th Sept., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,079; on Monday and Tuesday (free evenings), 5,733. On the three Students' days (admission to the public 6d.), 760; one Students' evening, Wednesday, 135. Total, 10,707. From the opening of the Museum, 592,147.

Home Correspondence.

MECHANICS' INSTITUTIONS AND SECONDARY EDUCATION.

SIR,—Your correspondent "J. C. B.," in the *Journal* of 27th August, proposes a plan for promoting secondary education, such as is usually given or ought to be given by Mechanics' Institutions, and, having carefully considered the matter in all its details, courts objections to it. I see several objections, not only to its being practicable, but to its being efficient for the purpose required.

In the first place, I doubt if so small an annual sum as the largest he names would prove a sufficient stimulus for that continuous study which is indispensable for proficiency, or whether it would really be any additional value to the certificate of the Society of Arts, the benefit of which has in many cases proved so very great as to be beyond a money appreciation. Indeed, I think much importance ought not to be attached to pecuniary rewards except it may be as a peculiar distinction to very superior attainments. The certificate, as a proof of merit, is the principal object of ambition, and making the gain of a prize an ordinary result of the examinations, is more likely to clog the whole scheme from the inevitable difficulty of obtaining the requisite funds. If the Society of Arts be enabled to carry out the system of examinations to the fullest extent, and their certificates be solely relied upon as the advantage to be acquired, there is an infinitely better prospect of success than if year by year money prizes were looked for, and want of means compelled the refusal of the anticipated grants.

Another objection is the almost insuperable difficulty of effectually carrying out such a scheme with anything approaching a satisfactory result. It would involve a complicate machinery of organisation almost impossible of attainment, and an expenditure even greater than the benefit conferred. It is also very doubtful whether the successful candidate would be any real gainer in the end. The few shillings paid as the reward of his studies would be so much less paid by himself, as the majority of the recipients would be already members of a provident society, so that the payment for his future use would be practically a present payment to himself.

Another difficulty, though not perhaps one of the same magnitude, is the want of continuous residence by a great number of those who would be candidates for examination. Many young men, having few local ties, seek to advance their position in life by removal to more active centres of manufacturing or commercial enterprise. With the certificate of the Society of Arts, as a testimonial of competency and good character, they seek employment elsewhere, and the annual payment would therefore involve an expense and trouble in the shifting of its application more than its real worth.

But if the scheme should prove successful in inducing a great number of candidates to strive for and obtain the coveted certificates,—if the many hundreds or even thousands of our young men who are capable of the desired attainments should swell the annually-increasing roll, from what source will the annual funds be supplied, or what security will be expected or can be given for annuities varying from 2s. to 7s. 6d., amounting in the aggregate to many pounds, and each item requiring careful supervision for its faithful administration. I doubt if "J. C. B." could follow out his well-meant suggestion by devising any mode of proceeding that would be really practicable.

The Society of Arts will do more real service by efficiently organising local Boards of Examiners, so that the advantages may be, as far as possible, brought home to the greatest number, and by confining the attention of the candidates to the value of the certificates as a legitimate object of ambition. If, however, it be thought desirable to add prizes, whether of books, money, or instruments, they should be provided from local sources, or given only in special cases, marking thereby the extra proficiency of the recipient. In any case, however, they should be but of secondary importance, so that the true value of the certificates be not in any way diminished, nor their acquisition thought less desirable. A reward should have some appreciable value, either present or prospective, but it would be difficult to discover what incentive to studious application in one of the difficult sciences would be afforded by an annuity of 2s. 6d., which is proposed for the holder of a third-class certificate, who would constitute by far the largest number. He may form, and not unjustly, the highest notions of the benefits he may gain as the holder of the certificate—the evidence of his attainments—but his hopes will hardly be elevated by the acquisition of the proposed addition, trifling in itself, though costly in the aggregate.

I believe that far more practical good would be accomplished by enabling the local boards to examine the members of Mechanics' Institutions, and award certificates for proficiency in the elementary branches of education. It would prove in many cases a very useful stimulus to exertion, and these minor certificates might be made a condition for examination in the higher branches. Unfortunately, and in Yorkshire especially, there are many Institutions where the elementary branches form the chief staple of education. These often require some inducement to promote attention, and though in most cases such examinations might be carried on very effectively by the respective committees of management, and small prizes made the reward of merit, yet I believe that the honour of gaining a certificate from a competent authority would prove in many instances a far stronger incentive.

It is well, however, that the subject should undergo discussion. It will gain from publicity, and if those who are actively engaged in promoting mental cultivation amongst the great mass of our industrial population would use the columns of the *Journal* more frequently, it could not fail to have some beneficial effect in keeping attention alive to the snbject. I am, &c.,

BARNETT BLAKE.

Leeds.

EXHIBITION OF 1861.

SIR,—I cannot by any means agree with your correspondent "T. L. E.," in last week's *Journal*, as to Battersea being a more eligible site for the Exhibition of 1861 than Kensington Gore. I deny that the former has "the triple advantage of road, rail, and river," in the ample sense he means, and which is essential to the pecuniary success of the undertaking. It may have it for those who live on the Surrey side of the river, though that I doubt; but for the masses who reside on this, comprising, as it does, the wealth, intellect, and public spirit of the metropolis and its swarming suburbs (Islington, Camden Town, Bayswater, Paddington, Brompton, Kensington, Hackney, Clapton, Tottenham, &c., &c.), Hyde-park is in every way more convenient. Even in 1851, when railway, omnibus, and cab accommodation was comparatively scanty, the facilities afforded for cheap and rapid conveyance were obvious from the multitudes who daily crowded the aisles and galleries of the Exhibition, even to the last hour that it was open. It was the knowledge of this fact which mainly prompted the efforts made to retain the building permanently where it stood, even though the promoters could hardly hope to offer such interior temptations as those which it originally contained. The removal of it, therefore, to Sydenham was deemed by many to be a great mistake, and I presume that, though it now presents attractions of nature and art beyond those of any spot in the world, no one will pretend that it has been hitherto a successful speculation. This I wholly attribute to the difficulties, real and imaginary, of access, which the additional railway facilities recently opened up to the public have not overcome to any appreciable extent.

The site of a building to be frequented by the many should not only be easy of access, but also enjoy the advantage of ready means of return. This was eminently the case in 1851, and is so now at the South Kensington Museum, which is a sort of epitomised edition of the Great Exhibition. Being in the neighbourhood of the parks, it is convenient for carriage visitors during the London season, for pedestrians from the district, and for those who use cabs, omnibuses, and other public conveyances. For the accommodation of the increasing numbers who already visit that collection of so much that is exquisite and instructive in painting, sculpture, mediæval art, educational appliances, and scientific apparatus, many additional omnibuses run from Islington and elsewhere at very cheap rates. And when visitors desire to return, they have no difficulty in finding these and other conveyances in abundance, close at hand. It fully answers the purpose of cab-proprietors to have "stands" near the Museum and elsewhere in Kensington and Brompton, for if they have not a sufficient supply of customers from that building, they can generally depend upon the miscellaneous wants of the district to make up the deficiency. Would that be the case at Battersea?

Even now, let those who return from the Crystal Palace by the new railway testify. I can speak from my own experience. For want of a populated vicinity, and therefore of a demand on which to depend, cabs are rarely to be found at the Battersea terminus, and omnibuses never. The last resource is the river, and if the supply of steamboats fails—and at present it is anything but abundant—those who have not their own vehicles are in a sorry plight, especially in bad weather.

But, besides all this, what do the thousands who now come up from the manufacturing districts know of Battersea? It is a terra incognita probably to the greater part of the residents of London, and of its northern and eastern districts, and can we imagine that it is less so to strangers?

Those who visit London for a short time, do not take up their quarters at Battersea or anywhere on that side of the Thames, and, if disposed to do so, where would they find accommodation? Sightseers prefer to frequent hotels which are as nearly equi-distant as possible from all the London lions.

All this has reference solely to the immediate pecuniary part of the question, arising from the payment made for admission, but something more may be urged against the locality advocated by "T. L. E.," on another score, viz., its moist and therefore dangerous atmosphere for works of art, and for fragile and coloured textures—in other words, for the bulk of the varied and valuable collection which is to constitu te the attractions of the proposed Exhibition of 1861. Who, with the danger of damage from this unfortunate peculiarity, would trust their property within its walls? It may be that this normal condition of Battersea-fields is much improved by drainage, but few would be willing to test the fact at their own risk; and under any circumstances, the prejudice against the locality, on this account alone, has to be surmounted. I need not remind you that this is a slow process.

On the other hand, the locality of Gore-house enjoys a vast prestige, principally the result of actual experience in 1851. I hope, therefore, that taking this into account, and giving to the foregoing facts and arguments the weight to which they may be fairly entitled, the editor of the *Builder* will continue to advocate the site of Kensington as every way suited for the Exhibition of 1861.

I need scarcely add that I write all this simply as a member of the Society, and not of the Council, with none of whom have I conferred on the subject.

I am, &c., THOS. WINKWORTH.

Gresham Club, Sept. 15, 1858.

Proceedings of Institutions.

BRISTOL.—A meeting of the Board of Examiners for distribution of prizes and certificates awarded by the Society of Arts to successful candidates from the Athenæum, was held on Monday evening, in one of the classrooms. The Rev. Canon Girdlestone presided on the occasion, and in opening the proceedings of the evening, said, that as the chairman of the local board of Examiners in connexion with the Society of Arts, there had been allotted to him the very pleasing office of distributing amongst the successful candidates at the examination in connexion with the Society of Arts, which was held in the Athenæum in the early part of the spring, those certificates of proficiency and prizes which had been

awarded to them. The Rev. Canon went on to speak of the efforts made for the improvement of middle-class education by the Universities of Oxford and Cambridge, and by the Society of Arts, congratulating his hearers on the results which had followed these examinations, especially the one which had taken place in connexion with the Bristol Athenæum, there having been only one failure, and also on the fact of permission having been first obtained through the instrumentality of this institution for ladies to compete. Throughout the whole country there had been only one other lady who had been successful, while the Bristol Athenæum had furnished four who had obtained certificates of proficiency in the French language. There were two gentlemen who had obtained certificates of proficiency in free-hand drawing; and one gentleman who stood alone in the list, to whom would be awarded a prize of £5, a prize of £3, and two certificates of excellence. Seeing that these prizes were bestowed for algebra, and conic sections, for trigonometry and similar subjects, he (the rev. canon) had no doubt that this young gentleman's head would be strong enough to bear the honours he had earned; and he congratulated the Bristol Grammar School on having produced so proficient a pupil. In conclusion, the rev. canon expressed a hope that the success which had attended the past examination would induce a still larger competition next year, and that the results would be proportionately gratifying. The following were the successful candidates to whom prizes and certificates were awarded amidst loud cheers: —Miss Eliza Hall and Miss Elizabeth McArthur, pupils of Athenæum French class, under M. de Candole—certificates of proficiency in French; Miss Margaret Lydia Lovell and Miss Alice Davies, pupils of Athenæum French class, under M. de Candole—certificates of competency in French. Francis Stone Evans, pupil of Bristol Grammar School, C. T. Hudson, Esq., master—1st prize, £5, in conic sections; 2nd prize, £3, in algebra; certificate of excellence in arithmetic, algebra, and conic sections; certificate of proficiency in geometry, trigonometry, and French. Thomas H. Yabbicom and James Craik, pupils of Mr. E. Beeks, Athenæum drawing master—certificates of proficiency in free-hand drawing. John Morris Harris, pupil of Athenæum French class, M. de Candole—Certificate of competency in French. Mr. M. Whitwill proposed a vote of thanks to the examiners, especially to those who were not directors of the Athenæum, which was seconded by Mr. Bell, and carried by acclamation. The Rev. Canon Girdlestone acknowledged the compliment, and stated that although his connexion with the Athenæum, from the commencement, had been a pleasureable one, nothing had given him greater pleasure than the examinations out of which the proceedings of that evening had arisen.

Londonderry.—The last report of the Young Men's Literary Association, speaks of the continued prosperity of the Institution. Its funds are satisfactory, its members are numerous, and the society is daily progressing in public favour. The want of such an association had long been felt in the city, and those who succeeded, at much personal trouble, in establishing the present society, may now rejoice to find that its advantages are almost universally appreciated, and that their young fellow-citizens are turning to practical account the facilities offered for instruction and improvement. During the past year the committee have exerted themselves to furnish the members with those facilities. The reading-room has been copiously supplied with newspapers and periodicals, lectures have been delivered, and sub-associations, for the departmental promotion of the great primary objects of the Society, have been spontaneously established by the members. Foremost among these they would notice the discussion class. In this class, debates, recitations, essays, and other literary efforts, form the business of weekly meetings; and the good results of this system of educational training were pleasingly exemplified on the occasion of a soiree recently held in connexion with this department of the association, and at which the addresses of the several speakers were such as would do credit to gentlemen of much higher pretensions. The committee trust that this discussion class will go on and prosper. They regard it as the germ of a valuable and most desirable movement. The progress of the other classes has been also cheering. In the Mercantile, French, and Music Classes, the work has been carried on with spirit, and with very considerable benefit to the pupils. With reference to lectures, Mr. Fitzgibbon, Q.C.; Mr. Henry M'Cay, LL.B.; Dr. Babington, Mr. Patterson, and Professors Dickie, Partington, and Thompson, with other gentlemen, have kindly given their services as lecturers during the season. Their lectures were, generally speaking, well attended; and, in reference to those held under the auspices of the Board of Trade, it affords the Committee no ordinary satisfaction to congratulate the Society on several of its members having eminently distinguished themselves in the subsequent examinations. Numerous prizes have thus been obtained by members of the Association. The new rooms of the Association, in Shipquay-street, occupy a most central and respectable position, and have been found most advantageous to members. In conclusion, the Committee desire to remind the Society that, unassisted by the members themselves, they can do but little. What they require is the active and persevering co-operation of the members. Let every person in the Association act as though he had an individual interest to maintain and an individual object to advance. Let the members urge their friends to join the society, and participate in those advantages which they have themselves experienced. If this be done, there need be little doubt that the Institution will flourish, and that it will enjoy a prosperous and permanent existence.

Poole.—In the report of the Town Library Literary and Scientific Institution, for 1858, the Committee congratulate the members on its continued prosperity. They cannot, however, but regret that little has been done towards reducing the debt still remaining. The lectures during the year have entailed a heavy expense on the Institution. Nine lectures have been delivered, at a cost to the Institution of £25 17s. 4d.; the receipts for which have only amounted to £6, thus leaving a loss of about £2 4s. on each lecture. Every care has been taken to prevent unnecessary expense in the arrangements for them, but it must be evident to all that if lectures are to be given, and if the members have the privilege of attending them gratuitously, they will always add considerably to the annual expenses; also, that if good lecturers are to be engaged, whether gratuitous or otherwise, if not residing in the immediate neighbourhood, the expense of each lecture cannot be much reduced. It should be recollected, in considering the expenses of the lectures, that the members, through a reciprocation of privileges with the Mechanics' Institution, have had the opportunity of attending also six lectures delivered for that Institution, without any expense to the Town Library. The conversazione also, for 1857, owing to the evening on which it was held proving very wet, preventing numbers from attending, instead of adding to, has drawn rather heavily on the funds—that, and the labour the arrangements entail on a few individuals, will prevent its being repeated annually, as was at first hoped might be the case by its promoters in the committee. The principal feature in the progress of the institution has been the establishment, from the nucleus that already existed, of a Museum of Local Natural History, Geology, and Antiquities. It is still in embryo, but the committee hope that in a few years it will become, by the combined efforts and hearty co-operation of the members and friends of the Institution, a first-class county museum, and prove an attraction to the town, which has at present but few objects of interest for the visitor. The committee earnestly invite the members and friends of the institution to visit the Museum, and to assist in the collection,

and by the donation of objects. In the possession of some of the ancient families of the town there are probably many relics of the past history of the town and county, which might be advantageously deposited by the present possessors in such a Museum, and by entrusting them to the care of the committee for the museum, they might render a great service to the town. The curator reports that donations of money amounting to £9 10s., in aid of the museum fund, have been already made, and enumerates various deposits of materials for the museum which have been kindly placed in his hands.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Sept.* 10, 1858.]

Dated 10th May, 1858.

1040. C. F. Vasserot, 45, Essex-street, Strand—Improved driving machinery, applicable either for thrashing, winnowing, cleaning, and bruising grain, cutting straw, or other agricultural purposes. (A com.)

Dated 19th July, 1858.

1620. C. F. Vasserot, 45, Essex-street, Strand—An improved artificial manure. (A com.)

Dated 12th August, 1858.

1836. G. Metzler, Great Marlborough-street, and J. Waddell, Brompton—Imp. in the construction and formation of valve musical instruments.

Dated 13th August, 1858.

1854. T. G. Pengelly, 5, Cheshunt-terrace, Waltham-cross, Hertfordshire, and H. Brown, Old-road, Enfield Highway—Imp. in apparatus for straightening gun-barrels.

Dated 14th August, 1858.

1858. J. Smith, Seaforth, near Liverpool, and S. A. Chease, Liverpool—Improved arrangements for obtaining and applying motive power.
1862. G. Betjemann, G. W. Betjemann, and J. Betjemann, Upper Ashby-street—An imp. in book slides.

Dated 21st August, 1858.

1902. G. J. Walker, Norton Folgate—Improvements in funeral carriages.
1904. R. A. Brooman, 166, Fleet-street—Imp. in sewing machines. (A com.)
1906. C. De Jongh, Lautenbach, near Guebwiller, France—Imp. in machinery for combing and heckling fibrous materials.
1908. W. W. Harrison, Sheffield—An imp. in cruet and liqueur stands.

Dated 23rd August, 1858.

1910. F. Puls, Roxburg-terrace, Haverstock-hill—Imp. in the distillation of bituminous matters and gas tar.
1914. A. Boyle, Birmingham—Imp. in the manufacture of certain parts of umbrellas and parasols, and in machinery employed in the said manufacture.
1916. H. D. Jencken, London—Imp. in electric telegraphs. (Partly a com.)
1918. W. H. Harfield, Fenchurch-street—Imp. in windlasses.

Dated 24th August, 1858.

1920. C. A. Schrader, Finsbury-square—An instrument to be used in boring, for mining or other purposes.
1922. J. Hine and A. Abrahams, St. John-street-road—Imp. in book slides or holders.
1924. J. Macintosh, North Bank, Regent's-park—Imp. in insulating telegraphic wires or conductors, and in apparatus employed therein, part of which apparatus is applicable to the manufacture of tubes from india rubber.

Dated 25th August, 1858.

1926. H. B. Barlow, Manchester—Certain imp. in machinery for preparing flax, wool, and other fibrous materials. (A com.)
1927. T. Hill, Heywood, Lancashire—Imp. in machinery or apparatus for punching and shearing metals.
1929. R. A. Brooman, 166, Fleet-street—Imp. in the treatment of vegetable substances in order to convert the fibrous portions thereof into pulp. (A com.)

Dated 26th August, 1858.

1931. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in bellows. (A com.)
1933. J. Black, Edinburgh—An improved mode or means of obtaining, applying, and transmitting motive power.
1935. S. N. Rodier, 21, Oak-village, St. Pancras—Imp. in apparatus for regulating gas.

Dated 27th August, 1858.

1937. D. Graham-Hope, Manchester—Imp. of locomotive and other steam engines.
1938. T. Trotman, 253, Albany-road, Camberwell—Imp. in hair pins.
1939. J. Ellisdon, Liverpool—Imp. applicable to reading chairs, and other articles used to sit or recline upon.
1940. F. Matley, Paris—Certain imp. in apparatus for regulating the flow of gas, and for improving its illuminating power. (A com.)
1941. W. S. Clark, Banbury—Imp. in reefing or furling sails from the deck of vessels. (A com.)
1942. W. Esson, Cheltenham—Imp. in wet gas meters.
1943. H. W. Hart, 69, Fleet-street—Imp. in the application of gas to chandeliers.
1944. F. J. Evans, Chartered Gas Works, Horseferry-road, Westminster—An imp. applicable to gas purifying.
1945. A. V. Newton, 66, Chancery-lane—Improved machinery for sorting silk or other thread according to its size or thickness. (A com.)
1946. W. E. Newton, 66, Chancery-lane—Imp. applicable to vessels employed in the manufacture of glass, or the melting of vitreous substances. (A com.)
1947. W. Kempe, Holbeck Mills, Leeds—Imp. in apparatus used for winding woollen and other fabrics on rollers, in order to such fabrics being boiled or faced when on the rollers.
1948. John Fowler, junr., Cornhill, and R. Burton, Kingsland-road—Imp. in the construction and arrangement of locomotive and other carriages, to facilitate their movement on common roads and other surfaces.
1949. R. Knight, Foster-lane, London—Imp. in apparatus for aerating liquids.

Dated 28th August, 1858.

1951. G. White, 34, Dowgate-hill, Cannon-street—Ambulatory furniture for apartments. (A com.)
1953. G. Coode, Westminster—Imp. in the adjustment of hose in machines for distributing liquid manure and other liquids over land; also for an improved method of, and apparatus for, manufacturing the hose to be used with such machines or otherwise, and for gathering and puckering canvas, linen, leather, and other textile and membranous substances.
1955. G. Weedon, 4, Poland-street, and D. W. Rice, 11, New-road, Woolwich—An improved knife and fork cleaning machine, part of which is applicable to other purposes.

Dated 30th August, 1858.

1957. J. Platt and E. Hartley, Oldham—Imp. in certain parts of machinery for preparing and spinning cotton and other fibrous materials.
1959. J. Brazil and J. McKinnell, Manchester—An improved method of indigo blue dyeing. (A com.)
1961. J. Brazil and J. McKinnell, Manchester—An improved method of indigo blue dyeing.
1963. J. Oxley, Camden Town—Imp. in baths.
1965. J. L. Clark, Adelaide-road, Middlesex, F. Braithwaite, Bridge-street, Westminster, and G. E. Preece, Bernard street, Middlesex—Imp. in telegraph cables.
1967. L. Wiart, Cambrai, France—An improved mode of generating steam or heating water or liquids.
1969. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction of governors or regulators for steam engines. (A com.)

Dated 31st August, 1858.

1973. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved apparatus for mounting the driving bands of machinery in movement. (A com.)
1975. J. Stoneham, Audenshaw, near Manchester—Imp. in cleaning and treating cotton and woollen waste or other fibrous materials, and in extracting oil or grease therefrom.

Inventions with Complete Specification Filed.

2022. G. G. Bussey, 12, Arthur-street, New Oxford-street—Holding and carrying cartridges.—7th September, 1858.
2023. W. Tucker, Rhode Island, U.S.—An improved variable boring bit.—7th September, 1858.

WEEKLY LIST OF PATENTS SEALED.

September 10th.

449. S. Wheatcroft.
511. S. T. Parmelee.
512. G. Pigott.
517. S. T. Osmond and E. D. Collins.
518. J. C. Martin.
520. R. Edwards.
522. R. A. Brooman.
526. J. Aked and J. Crabtree.
529. A. Wallis and C. Haslam.
531. E. A. L. D'Argy.
532. D. Gallafent.
533. G. Hall.
537. P. Le Capelain.
551. R. Glanville.
568. G. Williams & E. Rowley.
571. D. Evans.
596. A. Lester.
607. E. Coulon.
639. P. H. G. Bérard.
659. J. R. Breckon & R. Dixon.
697. H. Ward.
719. W. Clark.
720. W. S. Clark.
779. W. G. Armstrong.
786. J. Bailey, E. Oldfield, & S. Oddy.
811. J. H. Johnson.
833. E. F. Sans.
835. A. A. Lutéreau.
859. W. Clark.
861. J. Whiteley.
865. G. Finlayson.
929. J. Fraser.
947. A. V. Newton.
951. J. Martin.
963. B. E. Guyot de Brun.
979. W. Hopkinson and J. Dewhurst.
1049. J. Luis.
1061. J. Dyson, E. W. Shirt, and H. Shirt.
1315. J. Luis.
1431. C. W. Cahoon.
1458. W. E. Newton.
1503. A. V. Newton.
1545. W. Simons.
1558. W. Northen.

Patents on which the Stamp Duty of £50 has been Paid.

September 6th.

2047. E. Sharpe.

September 7th.

2032. R. B. Feather.
2058. J. C. G. Kennedy.
2111. J. Willis.

September 8th.

2057. M. Curtis and J. Wain.

September 9th.

2063. F. G. Spilsbury & F. W. Emerson.

September 10th.

2071. A. Longbottom.
2092. J. Lewtas.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 24, 1858.

PRODUCTION OF ORGANIC BODIES WITHOUT THE AGENCY OF VITALITY.

The following is an abstract of a lecture delivered at the Royal Institution, by Professor E. Frankland, F.R.S., F.C.S. :—

The earliest researches of chemists brought them into contact with two classes of bodies, distinguished from each other by well-marked and obvious peculiarities. One of them was met with in the inanimate or mineral kingdom, the various materials of which were distinguished by their comparative stability or resistance to change, and by the facility with which the greater number of them could be artificially produced from the elementary bodies composing them. The other class of bodies was found exclusively in the animal portion of creation, or was directly derived from the productions of the organs of plants and of animals: these compounds were distinguished by their proneness to undergo change, and by the impossibility of producing them by artificial means. By no process then known to chemists, could the elements composing these latter bodies be made to unite, so as to produce compounds, either identical with, or analogous to, the substances generated by the organs of plants and of animals. These substances were consequently, from their origin, termed organic bodies or organic compounds. They were regarded as dependent for their origin upon the influence of that aggregate of conditions sometimes called vital force; and it was generally believed, that we should never succeed in producing these bodies artificially, until we could form and endow with vitality the organs from which they were derived.

Such was the state of knowledge and opinion until the year 1828, when Wöhler succeeded in artificially producing urea, a body which had up to that time been known as a product of the animal organism.* This discovery was followed many years later by the artificial formation of acetic acid, which was produced by Kolbe from a mixture of protocholoride of carbon, water, and chlorine exposed to sunlight, the chloracetic acid thus obtained being afterwards converted into acetic acid by an amalgam of potassium. The subsequent production of methyl by the same chemist from acetic acid, added one of the organic radicals to the list of compounds producible from their elements. Although little further progress was made for several years in this department of chemical research, yet the artificial production of urea and acetic acid, together with their derivatives, completely broke down the barrier between so-called "organic" and "in-organic" bodies; and although the name "organic" was still retained for the class of bodies to which it had previously been assigned, it was now obviously no longer strictly applicable.

The recent ingenious researches of M. Berthelot have greatly extended this branch of chemical inquiry, and have in a most important degree increased the number of bodies capable of artificial formation. The production of chloride of methyl and the members of the olefiant gas family up to amylene ($C_{10}H_{10}$), furnish us with the whole series of alcohols and their derivatives, from amylic alcohol downwards. Phenylic alcohol and naphthaline, both artificially produced by Berthelot, yield a host of interesting bodies; whilst phenylcarbamic acid enables us to step from the phenylic to the salicylic group, since, when treated with hyponitrous acid, it yields salicylic acid. Lastly, M. Berthelot has succeeded in artificially forming glycerine, the basis of animal and vegetable oils and fats, and also in forming grape sugar; the latter however is obtained by the contact of glycerine with putrifying animal matter, and consequently cannot be said to be produced altogether without the agency of vitality; although the putrifying organic matter contributes none of its constituents to the new compound, and does not undergo any appreciable change in weight or appearance during the process. These substances yield such a numerous class of derivatives, that upwards of 700 distinct organic compounds can now be produced from their elements without the agency of vitality.

The processes employed for the artificial production of these bodies, though deeply interesting, present, with one or two exceptions, little or no analogy to the natural mode by which organic compounds are formed in the tissues of plants; but the speaker endeavoured to show, that a close attention to the nature of the inorganic materials assimilated by the vegetable kingdom, and their relations to the more important organic compounds derived from plants, leads to the belief that such compounds can be successfully produced by processes strictly analogous to those employed by nature. He contended that the constitution of the so-called organo-metallic bodies, in which the production of complex organic compounds from inorganic ones by the replacement of elements by organic groups can be so clearly traced, afforded a valuable clue to the formation of organic bodies in general, and led directly to the conclusion, that if the organic compounds of the metals be formed upon the model of the oxides of the respective metals, the organic compounds of carbon (that is, all organic compounds) are formed upon the model of the oxides of carbon.

It has long been known, that with slight and unimportant exceptions, the only materials employed by nature in the construction of the most complex organic compounds, are carbonic acid, water, ammonia, and nitric acid. The fact that a vast number of organic compounds are cast in the molecular mould of water, has been proved by the ingenious researches of Williamson and Gerhardt; whilst the wonderful fertility of the ammonia model has been amply demonstrated by the labours of Hofmann and Wurtz. It would also not be difficult to prove the claim of nitric acid to be considered as a third model upon which a number of other organic compounds are built up; but it was necessary to confine attention on the present occasion to the consideration of carbonic acid only, as a model upon which a very large number of organic bodies are formed.

Guided by the constitution above referred to of the organo-metallic bodies, and bearing in mind the replacibility of the oxygen in water and binoxide of nitrogen, and the chlorine in terchloride of phosphorus, by organic radicals, Professor Kolbe and the speaker were led to the following hypothesis regarding the constitution of several important classes of organic compounds.

1. The replacement of one atom of oxygen in carbonic acid by hydrogen or its homologues, produces an organic acid, either of the fatty or of the aromatic series, thus :—

Carbonic Acid.	Acetic Acid.	Benzoic Acid.
$C_2\left\{\begin{array}{l}O\\O\\O\\O\end{array}\right.$	$C_2\left\{\begin{array}{c}(C_2H_3)\\O\\O\\O\end{array}\right.$	$C_2\left\{\begin{array}{c}(C_{12}H_5\\O\\O\\O\end{array}\right.$

2. The like replacement of two atoms of oxygen in carbonic acid, produces either an acetone, or an aldehyde, thus :—

Carbonic Acid.	Acetone.	Aldehyde.	Oil of Bitter Almonds
$C_2\left\{\begin{array}{l}O\\O\\O\\O\end{array}\right.$	$C_2\left\{\begin{array}{c}(C_2H_3)\\(C_2H_3)\\O\\O\end{array}\right.$	$C_2\left\{\begin{array}{c}C_2H_3\\H\\O\\O\end{array}\right.$	$C_2\left\{\begin{array}{c}C_{12}H_5.\\H\\O\\O\end{array}\right.$

* The artificial formation of urea from cyanate of ammonia was exhibited under the influence of polarised electric light.

3. The like replacement of three atoms of oxygen in carbonic acid, produces an ether, thus:—

Carbonic Acid.	Vinic Ether.
$C_2\left\{\begin{matrix}O\\O\\O\\O\end{matrix}\right.$	$C_2\left\{\begin{matrix}C_2H_3\\H\\H\\O\end{matrix}\right.$

4. The like replacement of all the atoms of oxygen in carbonic acid, produces a radical, a hydride of a radical, or a double radical, thus:—

Carbonic Acid.	Ethyl.	Hydride of Methyl. (Fire damp.)	Methyl-ethyl.
$C_2\left\{\begin{matrix}O\\O\\O\\O\end{matrix}\right.$	$C_2\left\{\begin{matrix}C_2H_3\\H\\H\\C_4H_5\end{matrix}\right.$	$C_2\left\{\begin{matrix}H\\H\\H\\H\end{matrix}\right.$	$C_2\left\{\begin{matrix}C_2H_3\\H\\H\\C_2H_3\end{matrix}\right.$

The authors of this hypothesis now attempted to verify it by direct experiment. They endeavoured to avail themselves of the powerful affinities of zincethyl, in order to effect the substitution of oxygen in carbonic acid, and sulphur in bisulphide of carbon, by ethyl; these attempts were, however, at best only partially successful; the re-agent, the zincethyl, was not sufficiently powerful to rival the action of plants in the decomposition of carbonic acid; and its effects upon bisulphide of carbon resulted in the production of a number of organic bodies containing sulphur; and although one of these appeared to have the formula of sulphopropionic acid ($C_6H_5S_3+HS$), yet its complete separation and purification presented such difficulties, that it would have been hazardous to rely upon it as a proof of the correctness of their hypothesis. In short, the verification of these views was not permitted to their authors, but was reserved for Mr. Wanklyn, who, in his newly-discovered sodium and potassium compounds of the organic radicals, came into possession of re-agents which enabled him at once to effect the desired substitutions. His memoir on the production of propionic acid by the action of sodium-ethyl upon carbonic acid,* which has just been communicated to the Chemical Society, proves the first proposition of a hypothesis, which considerably simplifies our views of the molecular structure of organic bodies, and which, if proved to be throughout correct, cannot fail to enable us greatly to increase the number of organic compounds capable of being procured from their elements without the intervention of vitality.

The speaker then referred to the following list of important organic bodies, selected from the large number above spoken of, as being capable of artificial formation from their elements:—

Name.	Formula.
Oxalic Acid	$(C_2O_3, HO)_2$
Hydrocyanic Acid	C_2N, H
Light Carburetted Hydrogen	C_2H_4
Urea	$C_2N_2H_4O_2$
Formic Acid (Acid of Ants)	C_2HO_3, HO
Chloroform	C_2HCl_3
Acetic Acid	$C_4H_3O_3, HO$
Alcohol	C_4H_5O, HO
Ether	$(C_4H_5O)_2$
Olefiant Gas	C_4H_4
Acetic Ether	$C_4H_5O, C_4H_3O_3$
Oil of Garlic	$(C_6H_5S)_2$
Oil of Mustard	C_6H_5S, C_2NS
Glycerine	$C_6H_8O_6$
Butyric Acid	$C_8H_7O_3, HO$
Pine Apple flavour (Butyric Ether)	$C_8H_7O_3, C_4H_5O$
Succinic Acid	$C_8H_4O_6, 2HO$
Valerianic Acid	$C_{10}H_9O_3, HO$
Pear flavour (Acetate of Amyl)	$C_4H_3O_3, C_{10}H_{11}O$
Apple flavour (Valerianate of Amyl)	$C_{10}H_9O_3, C_{10}H_{11}O$
Lactic Acid	$C_{12}H_{12}O_{12}$
Grape Sugar?	$C_{12}H_{12}O_{12}$
Caproic Acid	$C_{12}H_{11}O_3HO$
Benzole	$C_{12}H_6$
Nitrobenzole	$C_{12}H_5NO_4$
Aniline	$N(C_{12}H_5)H_2$
Phenyl Alcohol (Creosote)	$C_{12}H_5O, HO$
Picric Acid	$C_{12}H_2(NO_4)_3O, HO$
Salicylic Acid	$C_{14}H_5O_5, HO$
Salicylate of Methyl (Oil of Wintergreen)	$C_{14}H_5O_5, C_2H_3O$
Naphthaline	$C_{20}H_8$.

The artificial formation of urea, lactic acid, and caproic acid, is interesting in connection with certain functions of the animal economy. Pine-apple oil, pear oil, and apple oil, are instances of the artificial production of the delicate flavours of fruit, whilst oil of wintergreen and nitrobenzole are like examples of the formation of esteemed perfumes. But of all the bodies hitherto thus produced, alcohol, glycerine, and sugar, are undoubtedly the most deeply interesting, owing to the part they take in the nutrition of animals: they prove to us the possibility of producing, without vegetation or any vital intervention, an important part of the food of man. Should the chemist also succeed in forming artificially the nitrogenous constituents of food, without which life cannot be maintained, it would then be possible for a man, placed upon a barren rock, and furnished with the necessary apparatus and inorganic materials, to support life entirely without either animal or vegetable food. No one of these nitrogenous constituents has, however, yet been artificially produced, and the absence of all clue to their rational constitution forms at present a formidable barrier to their non-vital formation.

It would be difficult to conclude a subject like the present without any notice of the considerations which naturally suggest themselves, regarding the possibility of economically replacing natural processes by artificial ones in the formation of organic compounds. At present the possibility of doing this only attains to probability in the case of rare and exceptional products of animal and vegetable life. Thus valerianic acid, which, for a long time, was extracted from the root of the *Valeriana officinalis*, could now probably be more cheaply prepared from its elements; but a still cheaper source of this acid has been in the meantime discovered, viz., the oxidation of amylic alcohol, a waste product formed in the manufacture of spirit of wine, and obtainable at such a moderate cost as to prevent, in an economical point of view, the successful production either of amylic alcohol or valerianic acid by any artificial and exclusively non-vital processes at present known. It is also highly probable, that if we could produce artificially such bodies as quinine and the rare alkaloids, or alizarine and similar powerful and valuable organic colouring matters, we should be able to compete with organic life in the formation of these bodies; nevertheless, the discovery of the processes of artificial formation would doubtless be preceded by a knowledge of methods by which such rare bodies could be produced from more abundant and consequently cheaper forms of vegetable or animal matter; and it is therefore exceedingly improbable that any purely non-vital process will be successfully, and at the same time economically, employed for the manufacture even of such rare and valuable vital products. Such being the economical bearings of the case with regard to the rare and exceptional educts of vitality, when we turn to consider the great staple products of the animal and vegetable kingdoms, the hope of rivalling natural processes becomes faint indeed. By no processes at present known could we produce sugar, glycerine, or alcohol from their elements at one hundred times their present cost, as obtained through the agency of vitality. But, although our present prospects of rival-

* This conversion of carbonic acid into propionic acid, was experimentally demonstrated, and the remarkable properties of sodium-ethyl and potassium-ethyl were also exhibited.

ling vital processes in the economical production of staple organic compounds such as those constituting the food of man are so exceedingly slight, yet it would be rash to pronounce their ultimate realisation impossible. It must be remembered that this branch of chemistry is as yet in its merest infancy, and that it has hitherto attracted the attention of but few minds; and, further, that many analogous substitutions of artificial for natural processes have been achieved. Thus, under certain circumstances, we find it less economical to propel our ships by the force of the wind, and our carriages by animal power, than to employ steam power for these purposes. We do not find it desirable to wait for the bleaching of our calicoes by the sun's rays; and even the grinding of corn is no longer entirely confided to wind and water power.

In such cases, where contemporaneous natural agencies have been superseded, we have almost invariably drawn upon that grand store of force collected by the plants of bygone ages, and conserved in our coal fields. It is the solar heat of a past epoch that furnishes the power which we now utilise in our steam-engines. One important element in cheap production is time, and it is precisely in regard to this element, that we economically supersede, in the above instances, the contemporary resources of nature. Now time is also an important element in the natural production of food; and although it is true, that the amount of labour required for the production of a given weight of food is not considerable, yet it is nevertheless true that this weight requires a whole year for its production. By the vital process of producing food we can only have one harvest in each year. But if we were able to form that food from its elements without vital agency, there would be nothing to prevent us from obtaining a harvest every week; and thus we might, in the production of food, supersede the present vital agencies of nature, as we have already done in other cases, by laying under contribution the accumulated forces of past ages, which would thus enable us to obtain in a small manufactory, and in a few days, effects which can be realised from present natural agencies, only when they are exerted upon vast areas of land, and through considerable periods of time.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The twenty-eighth annual session of the British Association commenced at Leeds, on Wednesday last.

The new Town-hall has been placed at the disposal of the Association.

The general committee assembled at one o'clock—the President (the Rev. Humphrey Lloyd, D.D.), in the chair. The following noblemen and gentlemen were also present:—Lord Goderich, Lord Monteagle, the Earl of Enniskillen, Lord Wrottesley, Sir Roderick Murchison, Professor Owen, Dr. Whewell, Dr. Latham, Sir B. Brodie, Col. Sykes, M.P., Mr. E. Baines, Sir John Rennie, Professor Faraday, Mr. Hopkins (Cambridge), Sir P. Egerton, Major-General Chesney, Dr. Gladstone, Mr. Monckton Milnes, M.P., Dr. Lee, Dr. Norton Shaw, &c.

The GENERAL SECRETARY (Major-General Sabine) read the report of the council, which, having referred to the unsuccessful exertions made by the Association to induce the late Government to send a vessel to the vicinity of Mackenzie's River, for the purpose of obtaining in that region certain observations which recent discoveries in terrestrial magnetism have proved to be of high importance to science, proceeded to state that the council had added to the list of corresponding members of the Association the names of the following foreign gentlemen, who were present at the Dublin meeting, and made communications to the sections, viz.:—Dr. Barth; Professor Bolzani, of Kazan; Antoine D'Abbadie, of Paris; Professor Loomis, of New York; Viscenza Pisani, of Florence; Gustava Plaar, of Strasburg; Herman Schlagintweit; and Robert Schlagintweit, of Berlin. With regard to the president of the Association for the year 1859-60, the general committee having resolved at the Dublin meeting last year to make application to his Royal Highness the Prince Consort for permission to elect him to that office, had received a reply intimating that his Royal Highness accepted the office, conditionally upon his being in Scotland at the time of the meeting.

The report was received and adopted.

The Parliamentary Committee reported that the late President of the Board of Trade, on a representation made to him by the association of the insufficiency of the accomodations and staff at the meteorological department at the Board of Trade, had consented to the appointment of two additional clerks and a working optician, to be permanently attached to that department; and, moreover, supplied more enlarged accommodations, so that, upon the whole, Admiral Fitzroy, who presided over this meteorological department, had expressed himself satisfied with the present arrangements and hopeful as to the future success of an Institution which could not fail to be productive of vast benefit to science.

The association expressed its extreme regret that the application to the Government to send the expedition to the Mackenzie River was unsuccessful; but they anticipated an important accession to our scientific knowledge from the expedition to the Zambesi River, which was sanctioned and sent out under Dr. Livingstone. That expedition had been well supplied with the necessary instruments, properly tested at Kew, and comprised those who were fully competent to use them.

The appointment of the Right Hon. Joseph Napier to the office of Lord Chancellor of Ireland had caused another vacancy in the Parliamentary Committee. There are now, therefore, two vacancies, one of which they recommended should be supplied by the election of the Right Hon. Sir John Pakington, First Lord of the Admiralty. The committee, referring to the proposed severance from the British Museum of the natural history collections, expressed their strong disapprobation of such a course, observing that "they knew of no measure which might be adopted by the Government or Legislature which would inflict a deeper injury on science than the removal of those collections, if unhappily carried out."

The first general meeting of the association took place in the evening, at eight o'clock, when the Rev. Dr. Lloyd resigned the chair, and the new president (Professor Owen) delivered the inaugural address.

The following is a list of the different sections as at present arranged:—

A.—MATHEMATICAL AND PHYSICAL SCIENCE.—President: The Rev. W. Whewell, D.D., F.R.S., &c.

B.—CHEMICAL SCIENCE.—President: Sir John Herschel, Bart., D.C.L., F.R.S.

C.—GEOLOGY.—President: Mr. Wm. Hopkins, LL.D., F.R.S.

D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.—President: Mr. Charles Darwin, F.R.S.

E.—GEOGRAPHY AND ETHNOLOGY.—President: Sir R. I. Murchison, D.C.L., F.R.S.

F.—ECONOMIC SCIENCE AND STATISTICS.—President: Mr. Edward Baines.

G.—MECHANICAL SCIENCE.—President: Mr. W. Fairbairn, F.R.S.

NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

The second annual meeting of this Association will be held at Liverpool on Monday, the 11th of October, and five following days. The local office and reception-room will be at St. George's Hall, Liverpool. The following prospectus, containing the order of proceedings and regulations for the meeting, has just been issued:—

I.—Order of Proceedings.

Monday, October 11.

Half-past One, p.m.—Meeting of the Council in the Library, St. George's Hall.

Half-past Three, p.m.—Special Service in St. Nicholas's Church. The Prayers will be read by the Rev. the Rector of Liverpool, and the Sermon will be preached by the Right Rev. the Lord Bishop of Chester.

Half-past Seven, p.m.—General Meeting in St. George's Hall. The opening address will be delivered by the Right Hon. Lord John Russell, M.P., and resolutions will be moved. Lord Brougham, the Earl of Shaftesbgry, and other leading members of the Association, will take part in the proceedings. Seats will be reserved for Members and Associates. The public will be admitted at two shillings and sixpence to the body, and one shilling to the galleries, of the hall.

Tuesday, October 12.

Half-past Ten, a.m.—The Lord Chancellor of Ireland, the Right Hon. W. F. Cowper, M.P., and the Right Hon. the Earl of Carlisle, K.G., Presidents of the first, second, and third Departments, will deliver Addresses to Members and Associates in the Concert-room, St. George's Hall.

One, p.m.—An excursion to the *Akbar* Reformatory Frigate. A steamer will leave the Great Landing Stage to convey the Members and Associates on board, returning at three o'clock.

Half-past Three, p.m.—The Right Hon. the Earl of Shaftesbury, and the Right Hon. Sir James Stephen, K.C.B., Presidents of the fourth and fifth Departments, will deliver Addresses to the Members and Associates in the Concert-room, St. George's Hall.

Seven, p.m., to Ten, p.m.—The Liverpool Academy, Old Post Office-place, Church-street, will open its Exhibition of Paintings to Members and Associates, who will be admitted on presenting their tickets.

Quarter to Eight, p.m.—The Philharmonic Society have invited one hundred and fifty of the Members and Associates of the Association (being non-residents in Liverpool) to the Concert in the Society's Hall in Hope-street. Tickets, which will be issued strictly according to priority of application, to be obtained at the Reception-room, St. George's Hall, on either the Monday or Tuesday of the meeting.

Half-past Nine, p.m.—The Mayor has invited the Members and Associates to a Soiree in the Town Hall. Tickets to be obtained in the Reception-room, St. George's Hall.

Wednesday, October 13.

Half-past Ten, a.m., to Four, p.m.—The Departments will meet in their respective rooms in St. George's Hall. Papers and Discussions will be taken.

Eight, p.m.—The Authorities of the Queen's College, Mount-street, have invited Members and Associates to be present at an Address to be delivered by Lord Brougham. Tickets may be obtained at the Reception-room, St. George's-hall.

Seven, p.m., to Ten, p.m.—The Liverpool Society of Fine Arts, Queen's hall, Bold-street, will open its Exhibition of Paintings to Members and Associates, who will be admitted on presenting their tickets.

Thursday, October 14.

Half-past Ten, a.m., to Four, p.m.—The departments will meet in their respective rooms in St. George's-hall. Papers and Discussions will be taken.

Seven, p.m.—The Right Hon. Lord John Russell, M.P., and other Members of the Association, will address a Meeting of the Working Classes. Further particulars will be announced.

Eight, p.m.—Soirée of Members and Associates at St. George's-hall.

Friday, October 15.

Half-past Ten, a.m., to Four, p.m.—The departments will meet in their respective rooms in St. George's-hall. Papers and Discussions will be taken.

Six p.m.—A public dinner will take place at St. George's Hall, Lord Brougham in the chair. Tickets, gentlemen, 21s., ladies, 10s. 6d., may be obtained at the Reception-room, St. George's Hall, or from Mr. Lynn, Waterloo-hotel, on and after Monday, 4th October.

Saturday, October 16.

Eleven, a.m.—Concluding meeting of Members and Associates in the Concert-room, St. George's Hall. Reports and resolutions.

On Wednesday, the 13th, the Jurisprudence Department will be occupied with a discussion on Bankruptcy Law Amendment, which will be supported by representatives from Chambers of Commerce, Trade Protection Societies, and other public bodies.

On Friday, the 15th, the Social Economy Department will be occupied with a discussion on Coinage, Weights, and Measures, which will be supported by the International Association.

A programme of the papers and other business will be issued daily during the meeting, at the Reception-room, St. George's Hall.

II.—Regulations for Members and Associates.

Any person becomes a member on payment of one guinea as an annual, or of ten guineas as a life subscription. Every member receives a ticket, which admits to all the meetings of the Association, and is entitled to the Transactions free of charge.

Any person becomes an associate for a year on payment of ten shillings. Every Associate receives a ticket which admits to all the meetings of the Association.

The Council invite ladies to enrol themselves as members and associates.

A limited number of tickets, transferable, ten shillings each, will be issued on the application of members only, admitting ladies to reserved seats, at the opening address, on Monday evening, and to all the meetings of the Association during the week.

In the book which will be transmitted with the members' and associates' tickets, will be found a list of the principal hotels and the lodgings recommended by the Local Committee. Refreshments will be provided in the Hall.

Members and associates are requested to enter their names, permanent addresses, and, if non-resident in Liverpool, their temporary addresses during the meeting, in the book provided for that purpose at the Reception-room, St. George's Hall.

A post-office for the use of the members and associates will be open at St. George's Hall during the period of the meeting. Letters should be addressed, "National Association, St. George's Hall, Liverpool."

The tickets are now ready, and can be purchased from the Local Secretary, George Melly, Esq., 7, Water-street, or the Local Treasurer, Arch. Briggs, Esq., 7, Walmer-buildings, Water-street, from whom all information can be obtained.

NORTHERN ASSOCIATION OF MECHANICS' INSTITUTES.

The annual conference of this Association was held at Alnwick, on Thursday, the 14th inst., under the presidency of Sir George Grey, M.P. There was a considerable gathering of delegates from all parts of the northern counties, among whom were Mr. Joseph Cowen, junr., of Stella-house, Mr. Ingham, M.P., Dr. Embleton, Beadnell; Mr. Tate, F.G.S., of Alnwick, and other friends of education. Mr. J. L. Thornton, the Secretary to the Association, read the report, which stated that the itinerating library had proved very successful throughout the rural districts; that there was an increase in the

number of societies in connexion with the union; and that the council had arranged a plan for a concerted series of lectures during the season. After the reading of the report, an interesting discussion took place on the subject of classes, in which Mr. Ingham, M.P., Mr. Joseph Cowen, junr., Mr. Tate, and other delegates took part. Mr. Joseph Cowen, junr., gave an interesting account of the successful efforts of the Blaydon Institution to extend popular education among the pitmen, keelmen, and other workmen in that Tyneside village. He also said that at the meeting at Gateshead last year, a proposition was made, he thought by one of the delegates from Gateshead, that, as efficient teachers were not forthcoming at the village societies, some attempt ought to be made to have one teacher for the different societies in the neighbourhood of Newcastle; that he should visit them in turn; and that by the different societies paying him a reasonable remuneration for his services, it would be worth his while to devote his time to the institutions *seriatim*. The institution which he (Mr. Cowen) represented acceded to this proposition, but few societies felt disposed to take it up. His society, however, determined they would do something on their own responsibility; and at the commencement of last winter issued notices of the commencement of classes for instruction in geography, history, and drawing, and he was glad to say that their first meeting for the establishment of these classes was extremely successful. After a week or ten days they were unable to afford accommodation for the number of pupils who attended. They therefore took an old building, previously used as a chapel for Wesleyan Methodists, and converted it into an efficient schoolroom, and there, for five months of last winter, and for five days in the week, they taught regularly a night-school, with complete success. The only difficulty they had was to find accommodation for the number of pupils that attended. They had an average attendance of something like 100, and the results were most satisfactory. He was persuaded that if similar efforts were made in other places, similar results would spring from them. They had had at Blaydon also a very successful experiment in regard to amusements. It was found that lectures on mechanical and philosophical subjects were not successful—that the number attending them was not sufficient to adequately remunerate the lecturer or pay the necessary expenses. They therefore adopted the plan of having some music—vocal and instrumental—and of imparting useful instruction between the pieces. He was very glad to say that this also had been successful, and that during the last winter, for six months, they had, every alternate Saturday night, entertainments of this description, and the average attendance each night was 400 or 500. The amount of good, social, moral, and otherwise, thus done in the village was considerable, and they had determined to commence a similar scheme this winter.

After the adoption of the report, the election of the council, &c., the right hon. chairman distributed the prizes for the best essays, and the conference broke up, to meet at Newcastle next year.

At the dinner, which was held at the Turk's Head, in the afternoon,

Sir George Grey, in proposing the toast "Prosperity to the Northern Association of Literary and Mechanics' Institutions," said that he could not fail to mention it as a subject of congratulation—that in the age in which we lived it was useless and superfluous to dwell upon the advantages of the diffusion of education and of knowledge. The time was happily gone by when, to use the language of a great writer, "The arrogance of learning could condemn to ignorance the great body of the people." The time was happily gone by, too, when the fears or apprehensions of one class of society could stand in the way or raise a barrier against the enlightenment and education of the great body of another. It was now universally admitted that knowledge is a blessing; and the only question which was discussed, the only thing upon which debates and difference of opinion arose, was as to the best means of effecting an object the value of which all concurred in. He believed there was nothing more true than a sentence which he found in an appeal lately issued by the council of this association in behalf of their itinerating libraries, soliciting aid for the continuance and extension of them—namely, that it was in vain to expect any marked improvement in the moral and social condition of the people, without affording them the means of intellectual culture and relaxation. This association was doing its utmost to carry out this object; and, therefore, he thought, it was deserving the support, the cordial support, of all who were anxious to promote the best interests of their fellow-countrymen. He most cordially concurred in the view put forward in a passage which was read from the report, in which it was stated that the object was the withdrawing men from the tavern and the alehouse, which would be frequented, in his opinion, whatever prohibitory laws were passed, so long as the tavern and the alehouse were the only resource which the working man had where he found social relaxation and intercourse. The best way to counteract that evil influence which was so much deplored by all, but which he hoped was losing its weight and diminishing in this country, was by establishing something which would be attractive to the working man, and which, while it would amuse and interest him, would also elevate and improve him. He thought the best mode of proceeding was to establish a reading room wherever a reading room could be established, accessible to the working man, comfortably lighted, with a cheerful fire, and with other requisites which were necessary in order to make it attractive; and by so doing they offered him, as a reasonable being, as a being accountable not only to the laws of his country, but accountable to God, enjoyments and objects of interest which, when once appreciated, would withdraw him from those debasing pleasures in which so many, in the absence of other objects of interest, were disposed to indulge. Sir George Grey then proceeded to speak of the advantages of some of the other means which the association employed for effecting the same object,—its lectures, its itinerating libraries, its evening classes and schools, and especially its system of examinations and prizes, which stimulated rising genius, and which were sufficient to induce men to devote their minds and faculties to the attainment of high and useful ends. Returning to the subject of reading-rooms, he thought that a useful and judicious selection of books was most important. He did not mean, by a useful and judicious selection of books, that they should very carefully weed their libraries of everything which the fastidious might think ought not to be there. It was by no means necessary that this should be the mode of dealing with libraries. Let there be books of all kinds in these libraries, but let the selection be a wise and judicious selection, with a view to put in those libraries books which, while they attracted, would also deeply interest, and would excite men to higher motives of action, and would supply them with examples to guide them in their course, in whatever sphere of life they might be placed. Before, however, he adverted to the character of the books which he thought it very desirable should be in these libraries, he wished to say a word on what he saw adverted to in many of the reports with reference to newspapers. He found rather a regret expressed that newspapers formed the principal attraction in the reading-rooms. In some cases, even, it had been thought almost necessary to separate the newspapers from other books, and to have one apartment for the newspapers and another for books, because newspapers diverted people's attention from what was most useful and valuable. For his own part he thought that, looking to the character of the newspapers of the present day—looking at the variety of information which they contained—looking at the ability with which they were written—at their descriptions of facts occurring

in all parts of the world, looking at the reviews of literary works which were found in them, even if newspapers were the only literary food presented in these reading-rooms, he would still advocate the reading-room being open, provided it was confined to newspapers, which it was evidently not desirable it should be; but he would not withdraw the newspapers from those reading-rooms, or attempt to divert men from the perusal of newspapers by excluding them from the room where other works were kept, because he believed that even from newspapers much valuable instruction and information might be gained, ecpecially as they were conducted in the present day; and he would encourage newspapers of a good class, containing, as many now did—even including in that class many of those which were published at the cheap rate of a penny, the latest information and events occurring in Europe, in London, and other distant places on the evening before. These cheap papers were conducted with great ability, and even they would be an admirable substitute for the debasing pleasures—if pleasures they could be called, which were afforded by the tavern and the publichouse. He would for a moment advert to what he saw alluded to in the report,—viz., works of fiction. He saw that a prize was offered for the best essay upon the expediency of admitting or excluding works of fiction from those libraries which were connected with Mechanics' Institutes. No essay had as yet been produced on this subject, and he did not know what view might be taken of it hereafter. The report rather invited opinion on it, and expressed a hope that what had been matter of such difference of opinion, and which had unhappily given rise to some ill-feeling, might be set at rest by the free consideration of it. First of all, he thought it most unfair to authors of works of fiction to class them together as a whole, and to draw a broad line of distinction between works of fiction and those works which were not of fiction. Some works of fiction contained admirable morals; some contained instruction of the highest character, and in a form in which perhaps no other works could convey it; and he thought it would be most injurious to the interests of those connected with those reading-rooms if works of this kind were excluded. He should therefore tender his humble service to the council of this association, if they were called upon to lay down any rule on the subject, not to exclude all works of fiction, because they would thus exclude what was deeply interesting to the great body of readers who frequented reading-rooms, and which would also be calculated to convey to them the highest moral instruction. The wise rule would be to look to the character of the work from its intrinsic merits rather than to draw any arbitrary rule, which he was sure would be most injurious to the interests of those for whose benefit those institutions were intended, and would tend very much to defeat the object which those had in view who were zealous in the promotion of them. It was, however, a subject of great congratulation that we had a number of books published from time to time which were not ephemeral, which were not works of fiction, but which possessed as deep an interest as could be possessed by any works of fiction, while they were calculated in the highest degree to elevate the minds of them who read them. He would refer to some of those which had been published within the last year. He would instance the life of a man they might almost call their own—George Stephenson, a man of whom the North of England might justly be proud. Who was there that could read that "Life of George Stephenson"—looking at his early struggles for knowledge, unaided by any of those advantages which the Mechanics' Institutes in the present day afforded to men similarly circumstanced, labouring to make the best use of that intellect which God had implanted in him—labouring with a success which made him one of the first men in Europe—without feeling the deepest interest in the narrative, and without feeling himself a better man for an attentive perusal of that work? George Stephenson was a self-educated man, for while he laboured successfully against all disadvantages in cultivating that intellect with which God had endowed him, he did not overlook the immense advantages which the means of high education afford, but he gave his son—the present distinguished man who bore his name, and who also was one of the first men for engineering talent in Europe—gave him the best education which it was in his power to command, showing how much he appreciated those advantages which these institutions set before the mechanic, and how much he valued those means which were now placed within the reach of all for the improvement of their minds and for obtaining that knowledge which was conducive to the highest ends. He would turn from the life of George Stephenson to the life of a man who moved in a totally different sphere, and whom, he was also proud to say, they might claim for the North of England. Who was there who had read any of those short and very interesting memoirs that had lately been published of that great and lamented soldier, General Havelock, who did not feel the deepest interest, who did not acknowledge that there was the highest instruction to be obtained in the perusal of the life of such a man moving altogether in a different sphere, and setting an example which some of them from their different circumstances might think they might not be able to follow, but still acting from a motive which must and ought to influence all—the highest motive which ought to regulate the conduct of men? Then, again, who was there that had read the narrative of th heroic defence of the beleaguered city of Lucknow by the garrison, cut off as they were from all intercourse with their fellow-countrymen, that did not admire the spirit which animated them, and feel himself incited to the highest deeds by reading the matter-of-fact commemoration of their daily trials and their daily exertions? He would mention another book which had only been published very recently, since the last meeting of the association, and which would not, therefore, be generally known; viz.,—"English Hearts and English Hands," written by an English lady, and recording in the most simple terms her experience among a class of men whose rough exterior and demeanour repelled most men—the men employed in making railways—and showing that beneath that rough exterior there was a soil well worthy of cultivation—a generous and noble feeling, only requiring to be called out by kindly intercourse with one who had most nobly devoted herself to their welfare. This book spoke of Englishmen in a way that was of thrilling interest, and conveyed this important lesson, "Go thou and do likewise." They might not all be able to do what she did, but let every one be animated by the same excellent feeling towards their fellow-creatures as she was, and then there would not be wanting the means by which they might benefit those around them, whatever their sphere of influence might be. Sir George Grey then referred to a work by Hugh Miller, called "My Schools and Schoolmasters," which gave the early autobiography of that eminent man. That book was one which he had read with the greatest interest, and with feelings of humiliation to think that with all the advantages one had possessed, one fell so far short of what he attained—unaided as he was by those advantages which others more favourably circumstanced had enjoyed. He had ventured to allude to those books rather as types of a class of works which, if placed in these libraries, could not fail, he thought—in connexion, let it be, with works of another kind, with newspapers and the best works of fiction—to attract and interest. People would not read because they were told to read, and because they were told a book was a good book; but if they found a book full of deep interest, full of narrative and facts, and all the more interesting because they were facts, that was the way in which, he was sure, they would get those reading-rooms frequented. They should attract people to them, and thereby carry on a successful

competition against the tavern, the alehouse, and the beershop. In connexion with these reading-rooms he certainly thought it was most important that means should be found for extending the itinerating libraries. There was a great advantage in having a change of books, and if these itinerating libraries—such libraries, he presumed, not always being of the same kind, but varying in the character and description of the books—if these itinerating libraries were sent about to remote villages and hamlets, and were there detained for three months, and then changed for others, the interest, which otherwise would flag, would be kept up. He would now for a moment advert to lectures. He thought that, however good lectures might be, they were not a substitute for reading or a substitute for books, but should only be regarded as a most useful auxiliary. The great object of the lecture was, in his opinion, to lead people to books, not to let them go away satisfied that they had got from the lecture what no lecturer would ever think or dream himself capable of giving them, a thorough knowledge of the subject on which the lecture was given; the great object of the lecture ought to be to excite an interest, to stir up the mind, and to excite that curiosity which was implanted in every man, and which only wanted a right direction. If lectures were so understood, if they were intended to stir up a spirit and taste for reading, then he thought they were in a proper place, and could not be too highly commended. Books, however, it had been observed by M. Guizot, in a recent work of his, in a sentence which was worth remembering, "Books are the tribune from which the world is addressed." Lecturers could only address the few present, confined within the walls in which they lectured, but books circulated among thousands. He therefore, still without undervaluing the advantages of those lectures, attached the greatest importance to the reading-room, to a well-selected library, and to the itinerating libraries. He would just advert to allusions which had been made, towards the conclusion of the report, to the complaint which had been put forward by some, that these Mechanics' Institutions had been failures. In one respect, and to a limited extent, they certainly had not answered the reasonable expectations of those by whom they were first advocated, and by whom they had been supported. There had certainly been an amount of apathy which was hardly expected among the great body of the working-people. They had not shown that interest in Mechanics' Institutions—that desire to avail themselves of their benefits, to the extent that had been hoped and expected would have been the case. At the same time, their growing influence showed that there was an increased appreciation of their benefits among the working classes generally. The friends of education should not be discouraged. Let them do as had been done at that meeting, let every man bring his own suggestions and his own experience into the common fund; and if they found that the result which they anticipated had not been attained to the fullest extent, let them consider whether it was not partly their own fault, and whether they were using the right means,—whether there was not something also which they could do which would tend to remove those obstacles which might have unhappily stood in the way of the complete success of these Institutions. A complaint was sometimes made that the knowledge obtained in them was all superficial, and would do very little good. He would mention the way in which one of the deepest thinkers, perhaps, of modern times, the late Sir James Mackintosh, combatted this objection. Though there was hardly any deeper thinker and better informed man than he, yet he ventured to become the advocate of superficial knowledge—not of superficial knowledge as against knowledge of a deeper kind, but superficial knowledge in those who had to choose between what might be termed superficial knowledge and ignorance. The great body of the people could not be profound, but, at the same time, the great truths which regulated the moral and political relations of men lay not very far below the surface, and it did not require that a man should be a philosopher, that he should go deep into the arcana of science, in order to apprehend those great moral and political truths. Sir James Mackintosh went on to say that the great works in which scientific discoveries were made, and scientific truths stated, were only read by a few; but that the truths which these works contained, pervaded gradually the minds of a reading people—even though that reading might be of a kind that was almost superficial, and, by a variety of almost unseen and circuitous channels, they penetrated everywhere, even to every shop and every hamlet. Let them not, therefore, be discouraged by thinking that all knowledge which by wise men, or rather by very learned men, might be termed superficial, was useless; and let no man abstain from entering upon the path of knowledge, and endeavouring to lead others to do the same, because they might not attain those heights which they might desire, but which circumstances placed beyond their reach. In conclusion, Sir George Grey alluded to the prospect of Examinations being held by the authorities of the University of Cambridge at Newcastle, and dwelt upon the advantages that these and similar Examinations afforded as an encouragement to persevering exertion.

MANUFACTURE FROM THE WASTE OF WOOLLEN MILLS.

A process was recently set in operation at the Kingholm woollen mills, in the neighbourhood of Dumfries, by which the hitherto refuse of the washing houses is converted into valuable commercial material, in place of being turned into the river Nith and adding to the pollution of its waters; and this process exhibits one of the most pleasing and interesting examples of the economical power of chemical science which has yet been seen.

In a woollen manufactory the first thing done is to wash the wool thoroughly. The same thing is done frequently when the wool has been spun into yarn, and always when the yarn has been woven into cloth. Wool in its natural state contains a considerable quantity of grease or animal oil; and it is besides oiled to enable the spinning process go on properly. Again the soap, which with a little soda forms the only washing materials used at Kingholm besides water, contains a considerable proportion of oil; so that it may be readily seen that the refuse water from the wash-houses is rich in animal matter. To turn this to account an apparatus has been erected at Kingholm, which we will endeavour to describe.

Iron pipes have been laid from each of the washing machines to a tank placed at one side of the wash-house, and the mouth of the pipe which runs from the machines washing wool is covered with perforated zinc plate to prevent any loss of raw material. A small force-pump, driven by the mill engine, lifts up the water collected from the various machines in the tank, and sends it through another series of pipes to a building which has been erected outside the mill and close to the boiler-shed, which at Kingholm is without the mill. The waste water flows into three elevated tanks in the building, which it enters at a temperature of about 120°. Each tank is provided with a small steam pipe from the boiler, and a jet of steam is occasionally introduced so as to bring the soap suds up to the temperature of 160°. When as much washing has been done as to supply sufficient suds to fill one of the tanks, and a proper temperature has been gained, a chemical preparation is poured into the tank, which acts with power upon its contents. The water, before being acted upon, is of a dirty white colour, and about the consistency of cream; gradually, after the acids and other substances have been introduced, a viscid scum rises to the top, while a quantity of matter is pre-

cipitated to the bottom of the tank, which it covers till about a foot in depth; both the floating and precipitated substances are chemically the same, but the latter sinks, owing to the sand and other impurities with which the suds are mingled. Betwixt the upper and lower layers of matter, after chemical action has ceased, is a mass of water nearly pure, the discoloration being very slight indeed, free from smell, and, we believe, slightly salt to the taste. By a very ingenious application this water is run off, and the scum which had floated upon it sinks down and is mingled with the precipitated matter. In the centre of the bottom of the tank there is an iron pipe, which leads to the sewer, and to this is jointed another iron pipe, the height of which is nearly equal to the depth of the tank. The pipe usually stands upright, and when the water is ready for being run off, the pipe is lowered so that its mouth is brought down to the top of the precipitate, by which means nothing but the clear water escapes. When this water has been discharged from the tank, the viscid mass remaining, which in consistency resembles slaked lime, is run through openings in the tank down to a series of bags of matting suspended upon trestles; here it remains for some hours until the water taken up has been drained away; and then a couple of spadefuls are enveloped in a canvas cloth; spadeful after spadeful is thus wrapped up and laid upon a wooden bed for further drying. When that has been sufficiently done, the cloths and their contents are subjected to pressure at a high temperature. The press consists of a square iron box and a screw worked by a fly-wheel; the cloths are laid upon iron plates until the press is full; steam is then admitted, and the screw applied, when slowly but steadily a stream of oily fluid is squeezed out into a small tank, leaving nothing within the press but layers of a substance resembling oil-cake in appearance. The oily matter is transferred to a large barrel, in which it is clarified by a chemical agent and the admission of a small quantity of steam. It soon becomes solid and fit for transport to the works of Messrs. Saundars and Smith, of Manchester, the patentees of this interesting process, where the reclaimed substance is bleached and otherwise treated, the principal product being stearine, which forms the basis of composite candles. The cake is used as a manure, and will be sold on the premises at Kingholm at 40s. per ton.

The process now described is already in general use in the seats of the woollen manufacture in England, and is being extended to Scotland. Already about 30 tons of the oily matter, yielding stearine and other substances, are weekly collected in England, and it is expected that 20 tons will be gathered every seven days from the manufacturers north of the Tweed.

The patentees are at the exclusive cost of erecting the whole of the apparatus, and pay the manufacturer a percentage for the use of his soap-suds, according to the amount annually expended in each mill on soap and oil. In extensive manufactories this amounts to a very handsome sum; while the millowner in pocketing this has at the same time the satisfaction of knowing that he sends into the stream which sweeps past his works a volume of comparatively pure water, instead of a turbid flood, not only dirty in itself, but poisoning sweet waters and injurious to fish.

There is another advantage connected with this admirable invention. From the rapidity with which the process is conducted, what are soap-suds one day becoming solid oil the next, there is no time afforded for decomposition, and the process is conducted without offensive smell, or being in any way a nuisance. Even the refuse from the extensive mills at Kingholm is turned to account by the labour of a single man in charge of the apparatus. There are three tanks in the building and one screw press, but a second press will be required to carry on the work properly.

Here, then, we have a valuable commercial product from which especially a pleasant light in the long winter evenings is obtained; an additional amount of artificial manure, for which every distant land is ransacked, procured at the farmer's door; the manufacturer of our Tweeds benefited as well as the owner of the apparatus; additional employment given both directly and indirectly; a step made in the purification of rivers and streams; all these procured from what was a waste and a nuisance—beneficial results of one application of chemical and mechanical science. Surely when this has been so thoroughly done, we may indulge the hope that the same sciences will ere long master the difficulties of the sewage question, and that our towns will be rendered healthful, our rivers purified, and our lands enriched by some process analogous to that which extracts good candles and manure from the hitherto wasted and despised soap-suds. —*Dumfries Courier.*

STAFFORDSHIRE BOOT TRADE.

It is stated that for some time past the manufacture of boot tops by machinery has caused considerable alarm to the workpeople, especially in Stafford, where most of the population are engaged in the boot and shoe trade, and where, as yet, no machine has been introduced. A short time since Messrs. Springthorpe and Newell, shoe manufacturers, called their hands together, and stated their intention of using the machine, and issuing machine-bound tops for them to make up. To consider the question a meeting of the trade societies has been held, at which it was decided to resist the introduction of machine-bound tops, and to guarantee aid to all who refused to make up such goods. Another and larger meeting of makers and binders (unconnected with trade societies) was convened by the public crier, and about 2,000 persons, of both sexes, assembled in the new covered market. Mr. Newell addressed this meeting, urging that it was useless to oppose the progress of machinery, and that opposition, if persisted in, would injure the trade of the town, as purchasers would go to those markets where they could buy the cheapest and best article. He admitted that the binders would be thrown out of work, but said that hands would be needed to manage the machines, and that more work would be provided for the makers. Several workmen, on the other hand, said the use of the machines would throw out of employ their wives and children, and entail poverty and destitution on many homes. A resolution, pledging those present not to make up any machine-bound tops, was passed by acclamation, and without a dissentient hand.

PEAT GAS.

It is stated in the *Dublin Freeman* that a village has recently been successfully lighted by gas made from bog peat. More than a year ago John Wilson, Esq., J.P., Daramona, Westmeath, had gas works erected at his private residence to light up that building, the out-offices, farm-yards, &c. Since that time he has used no other kind of artificial light than what was made from the turf of his locality. Within the last four months Mr. Wilson arranged with Mr. Johnson, the patentee of the process employed, for the erection of a second and more extensive apparatus, in order to light with turf gas a village on his property. The gas produced gives a pure and brilliant light. The enthusiasm of the people who had assembled to see the ceremony of first lighting the gas became loudly enthusiastic—cheers and every possible demonstration of gladness were vented at the success of the undertaking, and the indelible proof given of the fact that there is something in the bogs of Ireland.

SOUTH KENSINGTON MUSEUM.

During the week ending 18th Sept., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 3,783; on Monday and Tuesday (free evenings), 5,479. On the three Students' days (admission to the public 6d.), 615; one Students' evening, Wednesday, 127. Total, 10,004. From the opening of the Museum, 602,151.

Home Correspondence.

EXHIBITION OF 1861.

SIR,—On Mr. Winkworth's letter on the site of the proposed Exhibition of 1861, I wish to offer a few remarks. He completely ignores that the West-end Railway at Battersea will, before that year, be carried across the Thames to a terminus at Pimlico, within a quarter of a mile of Buckingham Palace, a spot easily reached by all the north-western suburbs. There is no reason why omnibuses should not be established to this new terminus, or to Battersea-park at cheap rates, as they were in 1851 to Hyde-park. Omnibus proprietors and cabmen are fully awake to their interest, and would not fail to profit by the stream of visitors that would be drawn to the Exhibition of 1861, wherever it may be established. If they are now wanting at Battersea terminus, Mr. Winkworth gives an excellent reason for it, by acknowledging the paucity of travellers to this terminus at present. There are vast populations in the eastern district of London, besides the mass of inhabitants on the south side of the Thames, and where steam-boat communication would save the nuisance and delay of threading through the crowded streets of London to Hyde-park. The recollection of 1851 must have proved to the visitors the confusion at times of having only one road to the Exhibition building, whereas Battersea-park will enjoy the advantages of the two rails thither; one from London Bridge, Surrey-side, and one from the new terminus at Pimlico, besides the river steam-boats. On the score of dampness, Mr. Winkworth confesses himself uncertain; surely that could be overcome, if it exists at all, by the scientific construction of the building, which, be it remembered, is intended solely for an Exhibition during the summer months. I am, &c.,

HENRY MOGFORD.

SIR,—I agree with Mr. Winkworth in thinking that the immediate neighbourhood of the old Exhibition of 1851 is the best site for the Exhibition of 1861. Mr. Winkworth has assigned good and valid reasons in favour of South Kensington. The truth, in my opinion, is that the advocates of Battersea-fields forget the great North of England population, and they further forget that the London and North-Western Railway Company has now one of their private stations for materials within half a mile of the Commissioners' land; and I cannot doubt that before 1861 the directors of that company will, with their usual forethought, make it a line for passenger traffic, thus enabling them to deliver, almost on the very spot of the Exhibition of 1861, exhibitors, goods for exhibition, and visitors from the entire North of England and North-east of London.—Yours, &c.,

A WELL-WISHER TO EXHIBITIONS.

Proceedings of Institutions.

GREENWICH.—J. Angerstein, Esq., of the Woodlands, Blackheath, has forwarded to Mr. Cobbett, of Deptford-bridge, the munificent donation of £100, to be expended by him on books for the library of Greenwich Literary Institution, which already consists of between 3,000 and 4,000 volumes. The members of the institution number nearly 1,000.

LONDON MECHANICS' INSTITUTE.—On Wednesday, the 16th inst., the certificates of the Society of Arts, obtained at the late examination by members of the London Mechanics' Institute, were publicly presented to the successful candidates, by Mr. T. A. Reed, Chairman of the Local Board of Examiners. Having given a brief explanation of the manner in which the preliminary and final examinations were conducted, Mr. Reed stated that nine members of the Institution presented themselves for examination by the Local Board, together with three members of other Institutions not having Local Boards of their own. Of these twelve, eight (all members of the London Mechanics' Institution) successfully passed the preliminary ordeal; but six only were able to present themselves for the final examination, one of the candidates having been prevented by illness, and another being a few weeks under the prescribed age. Of the six who were examined, one only was unsuccessful, and the remaining five obtained between them eleven certificates. This result was highly creditable to the candidates themselves and to the Institution in connection with which they had obtained these honourable proofs of their efficiency. It showed that the pulse of the old Institution was still throbbing; that, despite sinister forebodings out of doors, the time had *not* arrived when they were called upon to write its elegy and wish peace to its ashes. The result of the examination, he trusted, would have the effect of increasing the attachment of the successful candidates to the Institution, and operate as a stimulus to their fellow members to prosecute their studies with the like diligence, that on some future occasion they might meet with the like success. Not, however, that success was an accurate criterion of the value of the examinations; for it was obvious that the course of discipline which a candidate would pass through in order to prepare himself for the ordeal could not be otherwise than beneficial, whatever might be the result of the examination itself. Mr. Reed then intimated that the prize obtained by the Local Board for having sent up so large a proportion of successful candidates would be expended in books to be offered as prizes to some of the elementary classes of the Institute. The following certificates were then presented:—

Arithmetic.—Mr. James Dickie, Second-class Certificate (Proficiency).

Algebra.—Mr. Daniel Leggatt, Second-class Certificate (Proficiency).

Bookkeeping.—Mr. James Dickie, First-class Certificate (Excellence). Mr. William W. Snelling, First-class Certificate (Excellence).

Chemistry.—Mr. Thomas Shinn, Second-class Certificate (Proficiency).

Descriptive Geography.—Mr. James Dickie, First-class Certificate (Excellence). Mr. William W. Snelling, First-class Certificate (Excellence).

English Literature.—Mr. Francis Lynch, Second-class Certificate (Proficiency).

French.—Mr. James Dickie, Second-class Certificate (Proficiency). Mr. Francis Lynch, Third-class Certificate (Competency).

Latin Language.—Mr. Francis Lynch, Third-class Certificate (Competency).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Sept.* 17, 1858.]

Dated 4th August, 1858.

1774. J. B. Pascoe and J. R. Thomas, Chacewater, Cornwall—An improved method of and apparatus for feeding boilers of all steam engines with liquid, without the aid of the force pump heretofore used.

Dated 6th August, 1858.

1790. C. Barthémely, 27, Bush-lane, London—Certain imp. in hats.

Dated 10th August, 1858.

1820. R. H. Collyer, M.D. and C.E., 3, Park road, Regent's-park—An improved coating composition to protect vessels from marine animal and vegetable substances.

Dated 11th August, 1858.

1824. J. T. Pitman, 67, Gracechurch-street—An improved mode of operating apparatus for lifting and pressing. (A com.)

Dated 20th August, 1858.

1900. A. Baker, 6, Lambeth-road, Southwark—An improved method of and apparatus for submerging or laying under water electric cables, wires, or lines, and for the recovery thereof.

Dated 28th August, 1858.

1950. J. Ireland, Manchester—Imp. in cupola furnaces.

1952. W. Foster, Black Dike Mills, near Bradford—Imp. in the manufacture or production of fabrics known as fancy moreens.

1954. J. D. Brabazon, Lane's Hotel, St. Alban's place, Haymarket—Imp. in giving motion by sails to screw and other propellers of ships and vessels.

Dated 30th August, 1858.

1958. E. Massey, Tysoe-street, Clerkenwell—Imp. in ship's logs.

1960. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in billiard-tables and cues. (A com.)

1964. G. Jones, Bangor Wharf, Pimlico—Securing joints in slate ridge roll.

1966. E. Lindner, New York—Imp. in breech-loading fire-arms and ordnance, and in cartridges.

1968. T. R. Harding, Leeds—Imp. in the method of making straight or circular combs for flax, wool, or silk machinery.

Dated 31st August, 1858.

1970. E. Spary, Queen's Graperies, Park-street, Brighton—Imp. in fumigators.

1972. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Improved apparatus for the elevation of liquids. (A com.)

1974. F. Ayckbourn, Lyon's-inn, Strand—Imp. in the construction of beds and other articles for sitting or reclining upon.

1976. D. Heyworth, Featherstall Mill, Littleborough, Lancashire, and J. Heyworth, Prospect Mill, Hebden-bridge, Yorkshire—Certain imp. in looms for weaving.

1978. A. V. Newton, 66, Chancery-lane—An imp. in gas burners. (A com.)

1979. W. Rose, Hales Owen, Worcestershire—An imp. or imps. in piling or combining metals to be used in the manufacture of arms and cutlery, and for other similar purposes.

1980. A. V. Newton, 66, Chancery-lane—Imp. in air engines. (A com.)

1981. Capt. P. D. Margesson, Woolwich—Imp. in treating sugar canes and other canes containing saccharine matter in the preparation of food for animals, also in manufacturing sugar, and worts, or wash, for brewing, distilling, and vinegar making, and in applying the resulting fibre in the manufacture of paper.

Dated 1st September, 1858.

1982. W. Pursall, 22, Whittall-street, Birmingham—Imp. in the manufacture of percussion caps.

1983. W. Phelps, Red Lion-square—Imp. in wet gas meters. (A com.)

1984. W. Hobbs, 196, Piccadilly—Imp. in ordnance and warlike projectiles to be used therewith.

1985. J. Sloper, 215, Oxford-street—Improved means of and apparatus for indelibly crossing or marking bankers' cheques, drafts, documents, or other things, with a view of preventing erasures or fraudulent dealings therewith.

1986. H. C. Jennings, 8, Great Tower-street—Imp. in the manufacture of artificial parchment, and converting the same into leather.

1987. W. Warne, Tottenham—Imp. in the construction of elastic pavements and linings for walls, and in the manufacture of elastic mats, brushes, and pads for packing furniture.

1989. W. E. Newton, 66, Chancery-lane—Imp. in the construction of locks for doors, safes, and other purposes. (A com.)

1990. W. E. Newton, 66, Chancery-lane—Imp. in springs for carriages and other purposes. (A com.)

1991. S. Laing, Mill Wall—Imp. in the apparatus employed in the manufacture of gas.

Dated 2nd September, 1858.

1992. J. Walker and J. Barnes, Oakenshaw, Lancashire—Imp. in blankets and lappings for machine and block printing and other similar purposes.

1993. G. Price and W. Dawes, Wolverhampton—Imp. in steam-engines, steam boilers, and apparatus connected therewith.

1995. J. T. Pitman, 67, Gracechurch-street—An imp. or imps. in the construction of pneumatic condensing apparatus, for the purpose of compressing air, aeriform or gaseous bodies, preparatory to their use as prime motors, or for other purposes. (A com.)

1996. B. Winstone, 100, Shoe-lane—An imp. in the composition of copying and writing inks.

Dated 3rd September, 1858.

1997. J. M. Bellanger, 41, Rue de Trévise, Paris—Caoutchouc socks or clogs, with springs and without bridles.

1998. J. Robertson, Glasgow—Imp. in driving belts and springs.

1999. W. Harkes, Lostock Gralam, Cheshire—An improved plough and pulverizer.

2000. E. Cocker, Newton Heath, near Manchester—Imp. or imps. in machinery for spinning, twisting, or doubling cotton, flax, silk, wool, or other fibrous materials.

2001. G. T. Bousfield, Loughborough-park, Brixton—Imp. in knitting machinery. (A com.)

2002. R. A. Brooman, 166, Fleet-street—An improved apparatus for supporting the skirts of ladies' dresses. (A com.)

Dated 4th September, 1858.

2003. A. Guye, Clerkenwell—Imp. in the escapements of chronometers and watches.

2004. R. P. Lavie, Paris—Imp. in mills.

2005. R. A. Brooman, 166, Fleet-street—Improved apparatuses for receiving, containing, and delivering liquids. (A com.)

2006. W. H. Child, Providence-row, Middlesex—Imp. in hair and skin brushes.

2007. W. P. Piggott, 16, Argyle-street, Regent-street, and S. Beardmore, 37, Upper Berkeley-street—Imp. in vinous and fermented liquors.

2009. A. V. Newton, 66, Chancery-lane—An imp. in firearms. (A com.)

2010. H. Hyde, Truro, Nova Scotia—Imp. in the construction of carriage-springs. (A com.)

2011. A. Hills, Blackheath, Kent—A method or methods for the better securing the integrity or genuineness of bankers cheques or orders for money.

Dated 6th September, 1858.

2013. S. Hoga, 14, Nassau-street, Middlesex-hospital, W. P. Piggott, 16, Argyle-street, Regent-street, and S. Beardmore, Upper Berkeley-street—Imp. in submarine electric telegraphs.

2015. J. Ramsbottom, Accrington, and T. Watson, Baxenden, Lancashire—Imp. in machinery or apparatus for weaving.

2017. H. J. Distin, 9, Great Newport-street, Leicester-square—Imp. in cornets and other musical wind instruments.

Dated 7th September, 1858.

2019. W. S. Champness, 10, Osborne-terrace, Clapham-road, Surrey—Imp. in syringes for male and female use.

2021. E. Fullwood, Queen-square, Bristol—Imp. in the manufacture of cements.

Inventions with Complete Specification Filed.

2083. J. Luis, 1b, Welbeck-street, Cavendish-square—A new system of moulding without foundry pattern. (A com.)—14th September.

WEEKLY LIST OF PATENTS SEALED.

September 17th.

538. W. S. Clark.
541. W. Todd and J. Todd.
547. R. A. Brooman.
550. L. E. Fletcher.
555. A. Dunlop and A. Stark.
556. T. Suffield.
563. P. F. Aerts.
564. H. Brocklebank.
565. G. Scott.
573. J. Young.
574. J. Bramwell.
581. R. Mills.
585. J. Le Franc.
588. J. T. Pitman.
592. J. Thomas.
597. I. Holden and E. Hubner.
615. C. Chevallier, M. I. Olivier, and E. Rolland.
620. G. A. Biddell and W. Balk.
626. D. A. Hopkins.
628. J. Nuttall.
632. F. Foucou.
652. W. T. Eley.
658. W. Garnett, C. Geldard, and J. Dugdale.
662. J. Horton.
680. J. Musgrave.
698. W. E. Newton,
706. A. Pelez.
800. W. E. Newton.
832. J. Luis.
964. B. L. A. Peaucellier.
965. E. T. Hughes.
1416. C. Vero and J. Everitt.
1420. Sir J. Paxton, M.P.
1452. J. Luis.
1528. J. D. Weston.
1562. M. A. F. Mennons.

Patents on which the Stamp Duty of £50 has been Paid.

September 13th.

2070. J. H. Tuck.
2086. W. Sangster.
2091. J. Gray.

September 14th.

2088. D. Zenner.
2089. L. D. B. Gordon.

September 16th.

2102. R. A. Brooman.

September 17th.

2106. R. A. Brooman.
2113. G. A. Biddell.
2168. J. Good.

September 18th.

2119. J. Page and W. Robertson.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address
4118	Sept. 15.	Improved Hall Lamp	T. Patstone	8, Icknield-square, Monument-lane, Birmingham.
4119	,, 20.	Root Slicer and Cutter	S. Robb and J. Waudly	Oatwell, Cambridgeshire.

Journal of the Society of Arts.

FRIDAY, OCTOBER 1, 1858.

THE ECONOMIC USES OF NUTS AND SEEDS.

By P. L. Simmonds.

Anyone who passes through the bazaars and arcades, or notices the shop-windows of the metropolis, cannot but have been struck with the many new and ornamental applications of nuts and seeds which have come into use of late years, and which are greatly on the increase. There is yet, however, a very wide field open in the extensive productions of nature for profitable industry. The many applications of cameo and pearl shells to ornamental use, for studs, sleeve-links, breast-pins, &c., for pretty articles of bijouterie, or use for the boudoir and drawing-room table, and the large sale for such fancy articles, shows that a rich mine for the manufacturer and trader has been opened up. The fish-scale ornaments, from the hard transparent scales of the callipeva and other fish, first brought under notice by Chief-Justice Temple, in the columns of the Society's *Journal*, have now become a recognised trade, and brooches, bracelets, tiaras, &c., made of them, are largely vended in the galleries of the Crystal Palace. The turner, again, has profited largely by the extensive introduction of the vegetable ivory and coquilla nuts, which are applied to a great variety of useful and ornamental purposes.

In endeavouring to add to my private collection of industrial products the various applications which from time to time come before the public, I have been particularly struck with the new uses of nuts, seeds, &c., and as these form, perhaps, one of the most compact, ornamental, and popularly interesting sections of a museum, possibly a few collected notes respecting them may be useful.

In the great extension of this branch of trade we have one of the evidences of the utility of public exhibitions and economic or trade museums, as opening up suggestions and pointing out new materials to work upon. Our continental neighbours seem to be more ready and ingenious than ourselves in the application of nuts, seeds, and such small articles, to the purposes of decoration, and although, from their very cheapness, many of these ornaments are despised by our belles, yet none can deny their interest and beauty, and the taste in which they are worked up. The field is an exhaustless one, and many well-known ornamental nuts and seeds of India and South America have not yet made their appearance in this country. The most common applications of seeds and nuts at present are the betel nut, Job's tears, Mimosa seeds, the seeds of the wild liquorice, the Nicker seeds or Bonduc nuts, vegetable ivory, and coquilla nuts, &c.

The betel nut, the fruit of the *Areca Catechu* palm, loses with us its famous Eastern reputation as the popular narcotic masticatory. There the nut is sliced and used with pan, or the leaf of the betel pepper (*Chavica Betle*) and chunam, or shell-lime. The lime gives a deep orange or red colour to the colouring matter of the nut, and thus dyes the lips and tongue in the peculiar manner so common among the natives of India. All classes, male and female, chew it; and they allege that it strengthens the stomach, sweetens the breath, and preserves the teeth. In this country betel nut charcoal is often vended now by chemists as a tooth powder, but the imports of the nut being small, I very much question whether the greater part of that sold is really the produce of the betel nut. But it is the ornamental application of the nut with which I have here to deal.

The fruit (a nut) is yellow, oval, the size of an egg, inclosing an oily kernel, like a nutmeg, conical, rounded, pointed, and marked with white and reddish veins. When the outer coat is removed, these veins, or markings, have a very ornamental appearance. The nuts are either turned of a round shape, like beads, with striated lines, or flat, with ridges, like the petals of a flower, set with steel centre ornaments, and small intervening beads of the nut, and thus strung they form bracelets. In the Kew Museum there is a large walking-stick made of sliced betel nuts, fixed on a wire or centre.

A still more ornamental seed used for bracelets and rosaries, is the spherical corrugated seed of the *Elæocarpus ganitrus*, which are generally admired. In India they are known as Brahmin's beads, and when capped with silver they make very pretty ornaments.

The small round black seed of the Indian shot (*Canna Indica*) are often threaded as beads. But there is another use for them, and that is as a coffee substitute. Another round black seed, of a larger size is the kernel of the fruit of the *Sapindus Saponaria* (Linn.), of *S. marginatus* (Vahl), and other species, which is much used now for rosaries, necklaces, bracelets, and other ornaments. It is popularly known as the soap berry, for the aril which surrounds the seeds is used as soap in South America and India. The capsules or seed vessels are very acrid; they lather freely in water, and will cleanse more linen than sixty times their weight of soap; but in time, it is said, they corrode or burn the linen. This, however, requires confirmation.

The legumes of Acacia concinna (*Mimosa saponaria*, Roxburgh), form a considerable article of commerce in India. *Mimosa abstergens* fetches in the bazaars there about 1d. a pound, and if powdered 2d. a pound.

The Saponaceous principle, "Saponine," exists in many other seeds and roots, &c., as in the root of *Vaccaria vulgaris, Agrostemma Githago, Anigallis arvensis, Gypsophila Struthium* (the Egyptian soap root), various species of *Dianthus* and *Lychnis*, in the bark of *Quillaia saponaria* and *Silene inflata*.

The soap nuts are exceedingly hard and tough, and take a fine polish. The kernels of the small black nuts of *S. saponaria* are eaten in the West Indies, and deemed as palatable as the hazel nut or almond.

Dr. Sherwood mentions that the seeds of *S. marginatus* pounded with water, often put an end to the epileptic paroxysms, a small quantity being put into the patient's mouth.

The red seeds of the *Adenanthera pavonina*, a tree of the Mimosa tribe, often called red sandal wood in India, are much used for ornaments, weighing almost uniformly four grains; they are very generally employed by jewellers in the East as weights, so are the beautiful seeds of the wild liquorice (the *Abrus precatorius*), which are small bright red peas with a black spot. In India they are called goonch; very pretty rosaries, bracelets, and other trinkets are made of them.

The large seeds of the necklace tree of the West Indies (*Ormosia, coccinea*, and *dasycarpa*), of a brilliant red hue, with a black spot at one end, are now beginning to be used for sleeve-links and shirt studs. The Barricari seeds of Demerara (*Erythrina corallodendron*), a member of the kidney bean group, are also an ornamental seed.

The nuts of *Putranjiva Roxburghii*, called in Hindostan Jeeapootra, are strung by the natives round the necks of their children as an amulet to keep them in health.

The grey bead-like seed known under the popular name of Job's tears, are the stony fruit of a graminaceous plant (*Coix lachryma*). They are chiefly used in Catholic countries as beads for rosaries, but in times of scarcity they have served as food. They are also valued for some supposed medicinal qualities.

The large, bony, shining, grey, nearly globose seeds (*Guilandina Bonduc*, and *G. Bonducella*), called Nicker beans or Bonduc nuts, are used for bracelets and rosaries, and are very ornamental when set. They are very bitter, and have some medicinal properties, being considered emetic, and are used as a remedy for dropsy. The kernels of *G. Bonducella* are supposed by the native

practitioners of India to possess powerful tonic virtues, and are esteemed as a febrifuge.

Cherry stones, and other fruit kernels, are often seen carved and highly ornamented, made into rosaries, &c., evidencing the patience and skill of the workman who has laboured on them.

The small brown seeds, something like apple pips, so commonly used, when strung thickly together, for bracelets, work-bags, nets for the hair, and other ornamental work, are the produce of *Desmanthus virgatus.* They are frequently dyed black for effect.

Cloves, threaded and interspersed with beads, are also used for bracelets, and are made into a variety of ornamental work, baskets, boxes, &c.

The vegetable ivory nut, sometimes called Corozo, the fruit of a South American palm, the *Phytelephas macrocarpa*, Ruiz and Pav., is now largely imported, sometimes to the extent of 150 tons a year, and they have been sold at the brokers' sales at 8s. or 10s. a thousand, but they fetch now about 40s. a thousand. They come chiefly from the Magdalena river. The applications of the nut under the hands of the turner are most varied. Umbrella knobs, the reels of spindles, pincushions, children's rings, small humming tops, thimbles, cases, and a variety of toys and little knick-knacks being made from it. The interior or albumen of the kernel is as white and almost as hard as ivory, and is in great demand for turning. It is of the same nature, though not of the same consistence, as the flour of the cereal grains, the aromatic substance of the nutmeg, and the pulp of the cocoa nut, which in other palms becomes more hardened. That of the date palm is quite as hard, if not harder, but it is neither large enough nor white enough to be of use to the turner.

The Coquilla nut is the popular and commercial name for the fruit of the *Attalea funifera* palm of Martius. Being excessively hard, beautifully mottled with dark and light brown, and capable of taking a very high polish, they are extensively used by turners for making the handles of bell-pulls, napkin-rings, the knobs of walking sticks and umbrellas, humming-tops, rosary cases, and such like. Several hundred thousand of these nuts are imported annually from Brazil, and sold at about 30s. the mille. The principal use of these nuts now is for waistcoat buttons, which are largely used at Birmingham, and they are coloured different tints to suit different cloths. The palm which bears these nuts also furnishes the strong piassam fibre of commerce, so largely used in making brushes and street-sweeping machines. The seeds of many of these palms are eaten by the natives of the countries in which they grow.

The seeds of the shreetaly or talipot palm (*Corypha umbraculifera*) are a species of vegetable ivory, capable of being turned into marbles or beads, and cut into button moulds, draughtmen, &c. They could be obtained in large quantities in Canara and other parts of India, but have not been introduced into England. A kind of flour is obtained from the nut. Another pretty palm nut is that of the Macaw (*Acrocomia sclerocarpa*, Mart). It is often turned and carved into small ornaments abroad. I have finger rings, sailors' rings for their neck ties, and other small articles made from them. On removing the outer coat, the nut has a beautiful black hue, which takes a fine polish, but they are too small to be commercially useful.

The uses of the coco-nut shells, from their familiarity, are now less appreciated. But we still see them carved and polished on the exterior and made into baskets and spoons, or mounted in silver as drinking goblets. They are also used for cups, elegantly carved sugar basins, lamps, skimmers, and by the Polynesians, as well as other natives, entire, for containing their water, having two holes in the summit. The largest nuts are chosen for this purpose, and are often seen highly polished, and of a fine black colour. The shells will also make good lamp-black, and, reduced to charcoal and pulverised, an excellent dentrifice. They are manufactured into beads for rosaries. The common ladle used over a great part of India and in the Brazils is formed of part of the shell, to which a long wooden handle is fixed. Particular virtues have been attributed to cups made of the shell of the coco-nut. They have been supposed to give an anti-apoplectic quality to intoxicating liquors.

"The double cocoa-nut (*Lodoicea sechillarium*) of Labillardière, was once held in great repute for all sorts of fanciful properties, from the ignorance which prevailed respecting its origin. The great men of the East formed of the shell precious vessels, cutting off a transverse slice, which constituted the lid, and in this they put their tobacco, betel lime, and whatever else they masticated, believing that these articles could never be contaminated by anything noxious. Water kept in it was considered to preserve those who drank of it from every complaint. The discovery of the Scychillio Islands, and the knowledge thence derived that these nuts grew upon trees, as other coco-nuts, soon reduced their value, and now probably, by the East Indians as by the Europeans, they are only sought as a matter of curiosity, or for domestic purposes.

"Of the nut are made vessels of different forms and uses. When preserved whole, and perforated in one or two places, the shell serves to carry water, and two of them are suspended from opposite ends of a stick. Some of these nuts hold six or eight pints. If divided into two between the lobes, each portion serves, according to its size and shape, for plates and dishes, or drinking-cups, these being valuable from their great strength and durability, so that this kind of utensil, in the Scychillio Islands, bears the name of *vaiselli de l'Isle Praslin.* Amongst other articles, shaving-dishes, black, beautifully polished, carved, and set in silver, are made from them."—*Seeman's Palms.*

The stony seeds of the Tucuma palm (*Astrocaryum Tucuma*, Mart.), are in Brazil turned into rings, "birros" or knitting pins, and other small articles for which bones are employed. The seeds are so hard that it is almost impossible to break them, except by a powerful blow with a large hammer. The kernel (albumen) is also very hard, nearly approaching to vegetable ivory. The kernel of the fruit of the doom palm is turned into beads for rosaries.

Several kinds of hard brown beans have lately been brought into use for making bracelets and other ornaments. Their plainness and monotony is varied by gilt or steel studs and settings, and small beads intermingled with ornamental pendants. The large horse-eye bean, the seed of a species of *Mucuna*, is really ornamental, and curious when mounted for bracelets. The large brown sword beans of *Entada Gigalobium* and *E. Pursaetha* are made into spoons, small coin cases, scent bottles, &c. They are used by the natives of India, under the name of "Gel," with soap berries for washing their hair.

The seeds of the pod of the Carob tree (*Ceratonia siliqua*), are said to be the original carat weights of the jewellers. It is strange that these seeds, and those of the tamarind, date, &c., have not been applied to some economic use with us.

The locust pods or carob beans, as they are termed, have come largely into use as a cattle food in this country, although they were first introduced at a high price in the chemists' shops as an improver of the voice. Vocalists were assured that like the sweets recommended in the extempore doggrel of a well-known and popular itinerant vendor, they would—

> "Clear your voice, and make you sing as well,
> As notes of music, or the nightingale."

In the Portuguese settlement of Ambrez, Africa, the seeds of the custard apple are strung upon thread as necklaces, and in the Kew Museum are rosaries made of olive seeds and stones. Immature oranges, turned and polished, make very pretty rosaries, having a pleasant

odour, and they are also sold in chemist's shops as "issue peas."

Walnut shells are frequently mounted with hinges, &c., and used as the ornamental cases for miniature articles, such as scissors, thimbles, &c., and the Limerick gloves are packed in them, while jewels and other presents are often disguised in this rough case as an agreeable surprise. Calabashes, the hard rind or covering of the fruit of the *Crescentia Cujete*, are used for all kinds of domestic utensils in Africa and the West Indies. Cups and saucers, baskets and bowls, pepper and salt dishes, &c., of various sizes, plain or carved and ornamented, take the place of crockery, and are not so easily broken or destroyed. I have them in my collection in all sizes and styles. Many will stand the fire for cooking as well as an iron pot.

Under the name of bottle-gourds the hard and rough rind of the fruit of the *Lagenaria vulgaris*, cleared of the pulp and seeds, is used like the calabash for ready-made bowls and vessels for holding water. Snuff-boxes, again, are made by the Africans of *Oncoba spinosa* in Natal and Gaboon.

Having touched upon their purely ornamental applications, I may have a few words to say in a future number upon the edible uses of some of the ordinary nuts and seeds, and others that have been less generally utilized.

8, Winchester-street, Pimlico, Sept. 28.

BRITISH ASSOCIATION, LEEDS, 1858.

TRADE AND COMMERCE.

The following paper on "Trade and Commerce, the Auxiliaries of Civilisation and Commerce," by Mr. Bazley, of Manchester, was read before the Section of Economic Science and Statistics, on Thursday, the 23rd ult:—

Now, as of old, industry is the source whence proceed the supplies of the innumerable products of nature and of manufacturing art. The present age is distinguished not only by an amazing increase in the articles which result from the cultivation of the earth, and from the skill of the artisan, but new powers of production having been discovered, augmented supplies of all things necessary to the existence of the human family as well as of those things which adorn and gratify, yield their comforts and embellishments, and have consequently called for a correspondingly extended distribution. Happily these beneficial agents—production and distribution—have co-existently contributed to the visible and valuable results of modern industry, and this therefore is a pre-eminently practical age. Philosophers, theorists, and inventors have been prolific indicators of improvements; but till Watt and his successors combined the principles of science with the skill of the artisan, and demonstrated by the subjugation of manufacturing difficulties, and by the contrivance of mechanical agents, which became working benefactors, the fruits of scientific knowledge were only first sparingly partaken of. Stores of learning and of science have smouldered in the libraries of their possessors, great multitudes of people in every country have been subjected to the darkening influences of ignorance, though, in slow and uncertain progress, the elements of a new development were advancing; and the test of practical utility thus determines the merit of philosophic propositions, whilst the emanations of the untaught, whose experience as apt workmen has led them to invent and improve, are perfected by the superior application of mental skill, guided by true and enduring principles. Domestic and mere hand labours were the burthens borne alike in every large community, and in the households of the rustic cottage, or of the stately mansion—the distaff and spindle producing home-spun woollen or flaxen yarns; the shuttle with the hand loom and the knitting needle being the implements employed to supply the clothing wants of every family. About the middle of the eighteenth century, however, the whisperings of intelligence began to tell of magic wonders which water and steam power—with manufacturing appliances to arise from new mechanical contrivances—should produce, and then opened that remarkable era which called coals and metals from the mines to minister to the formation of a gigantic manufacturing system, when domestic industry was proved to be inadequate to provide for those new wants which increased knowledge and refined desires showed their possessors that they required, and which might be gratified with benefit to extending industry. Manufacturing establishments became signs of progress; employment and consumption equally increased; migrations of labourers to districts needing additional hands took place; wages were more extensively paid; expenditure from enlarged earnings fructified by fostering new demands for the necessaries of life, thereby widening the foundation on which the new structure of industry should be erected; and the application of mechanical power having led to a vast increase in all the productions which could contribute to the comforts of life, machinery was proved to be creative, and not destructive, of beneficial labour. The rise and progress of the cotton trade will probably best confirm and support these views, which are indeed applicable to every branch of national industry. The growth of cotton is indigenous in those countries which border on the tropical regions. From time immemorial cotton has been grown and manufactured in the East Indies; and no doubt 3,000 years ago the Hindoo wore garments made from this material, not dissimilar to the cotton clothing now supplied from places then unknown, and where the cotton plant cannot thrive, but which industry and machinery have rendered practically the home of this greatest of modern occupations. Asia and Africa were the earliest fields whence cotton was gathered, and though Turkey in Europe, Spain, the Isles of Greece, and the south of Italy, have in the middle ages grown cotton, for the United States of America was reserved its latest introduction, most extended cultivation, and vastly the largest production. Some 70 years ago the seed of cotton was first imported into America, and sown, and when its planter beheld with delight his few acres of ground white with their downy harvest, he exclaimed with foreboding alarm, "This cotton may be made into more stockings than the world needs," yet its value would not exceed £100; whilst, since then, in the very short period of its production in that country, so amazing had been its increase, that £40,000,000 stirling may be estimated as the worth of the last year's yield. Probably from the most remote ages, the arts of spining and weaving were practised by the human hand. In patriarchal times needlework was highly esteemed, and in every subsequent period this useful accomplishment has been possessed by women of the highest rank, and by those resident in courts, as also by the squaw of the rude Indian, and by the housewife of every country. But to modern efforts must be attributed, as exemplified in the cotton trade, those enormously large productions of the textile fabrics, whether of the plain and useful, or of the fanciful and ornamental which have placed alike in cottages and palaces comforts and decorations to which the ancients were strangers. In 1758 the imports of cotton and its consumption by domestic labour might be three millions of pounds weight for the entire year, but in the present year, a century afterwards, the quantity consumed will be one thousand millions of pounds, of which the United States supplies three-fifths, the other two fifths being obtained from the East Indies, South America, Egypt, and the West Indies. For the last year, by the return made by the Board of Trade, the exports of cotton manufactures, sent to every part of the world, amounted to upwards of £39,000,000 sterling; hence this large sum becomes the agent of payment to a corresponding extent for imports, but in thus largely aiding in procuring increased

supplies of foreign products, whether in gold, silver, raw materials, food, wines, sugar, fruits, or luxuries of distant growth, which are received into the United Kingdom, there is the satisfaction that our cotton industry has contributed clothing comforts to the benefit alike of the savage and civilised in every region of the earth. In this current year the exports of cotton manufactures will perhaps amount to £40,000,000 value, and the portion left for home consumption may be £24,000,000, or equal to 17s. per head for the population of this country; but as the cotton trade of Great Britain is not half its magnitude in the entire world, including the domestic and semi-domestic manufacture, still extensively carried on in the East, the manufacture of the world at large cannot be less than the annual value of £140,000,000, and therefore this industry affords to the world's population three shillings worth each of cotton clothing, or represented in calico 14 yards per annum for every man, woman, and child in existence. Presuming the cotton industry of this country to amount to £64,000,000 in value for the current year, and the cost of the raw material to be £24,000,000, then the sum remaining for wages, interest of capital, rent, taxes, fuel, freight, carriage and other requisites, will be £40,000,000. The population employed in this trade exceed half-a million, and as every worker is said to be connected in his family with three non-workers, who depend upon the single worker for subsistence, two millions of people are therefore supported by it. Engineers, founders, machine makers, and other auxiliary traders employ vast numbers of well paid-workmen, who are constantly engaged and sustained at the cost of capital invested in the constructive department of the cotton trade; hence these further sources of support increase the total number of people dependent upon this extraordinary industry. But those mechanical artisans who are not directly visible as spinners and weavers, and whose labours cannot be measured by the immediate production of yarn and cloth, are essentially contributing services of greater importance than either; and as capital accumulated by the trade itself, and derived from other channels, has been constantly and progressively in the course of investment, the employment and consequent expenditure of that capital in wages cannot be overlooked, although it does not appear to be recorded in the form of exported or of home-consumed manufactures. Compared with the world's history, the cotton trade may be regarded as having only existed during a mere atom of time. The inventor of attenuating cotton by rollers, whether Wyatt or Arkwright is unknown, but the latter took out a patent for it, and for spinning upon the throstle, in 1767. Hargreaves, who invented the jenny by which the attenuation was effected only by elongation and recession, matured his machine about the same time, and the talented Crompton, whose contribution to the mule gave the greatest impulse to the trade, and whose invention now fills its vast factories, only effected the alliance of the throstle with the jenny in 1787, when he completed that machine of immense merit, giving mechanical life to the laborious and beneficial mule, which then entered upon its successful and profitable career. The total number of cotton spinning spindles in the United Kingdom may be now 30 millions, and in addition there are power-looms and other machines in very great numbers, thus warranting an assumption that 50 millions sterling have been invested in the machinery and buildings of this trade in this country alone; and if the capital of the auxiliary trades, as well as that requisite for carrying on this industry, be included, the total capital employed will exceed £100,000,000 sterling. If, however, Watt had not improved the steam-engine, and developed the dormant usefulness of mere vapour, a serious barrier to the progress of industry, aided by mechanical inventions, would have remained as a retarding obstacle; but in 1774 he was called from Scotland to Birmingham, where he began the construction of that engine which his partner, Boulton, told George III. produced the object of the love of kings—power. And as if to feed this infant industry, at this period cotton was first grown in the United States and thence supplied simultaneously when Crompton's triumphant discovery appeared. Viewing Lancashire as the chief seat of this industry, if we refer to the population of this county 100 years ago, we find it to have been about 300,000, whilst now it numbers 2,000,000 more, or 2,300,000, making an increase greatly in excess of any of the old trading and agricultural communities of this or of any other country. The individuals who migrated into this country did not leave behind them happier and better homes than they obtained by the change; they did not vacate places of greater profit; and they did not move from their old and parental abodes to accept from those who were establishing a new industry, either fewer comforts or lower wages than they had previously enjoyed. With the new trade of Lancashire, Liverpool became the port for the reception of its raw material and mercantile returns, and for the distribution of the superabundant goods which were produced, and thence shipped to every opening foreign market. Liverpool, in 1758, was little more than a bathing and fishing station; its tonnage then might be 100,000; but, having grown with the growth of the cotton trade, its tonnage for the current year may be stated at 5,000,000. The splendour of the docks, filled with ships loading and unloading, of the public buildings, and of the town itself, proclaims Liverpool to be a seaport of no secondary importance; and its attributes establish it as a representative of a vast industry, and the commercial purveyor of necessaries and comforts for great numbers of mankind at home and abroad. Camden relates that the southern and western parts of Lancashire were once a morass, without roads and facilities of communication; its agricultural condition generally being unproductive, the abodes of the labourers were miserable, and, in addition to great natural disadvantages, an expiring feudal system left the people as degraded as they were wretched. This county now, however, is filled with flourishing towns; it is intersected by roads, canals, and railways; its rivers have the safe conduct of bridges; its soil is cultivated alike to the advantage of its owners and to the teeming population which obtain a portion of their food from it: and its abundant mines supply that indispensable fuel which gives power to the modern engine of propulsion, and thence to the spindle and to the loom; to the locomotive; to the proud steamer which defies wind and wave; and which also warms the hearths of all. Manchester, as the chief manufacturing city of this county, has advanced in the full ratio of its increasing industry, with Liverpool and the other portions of the county. In 1758 the population of Manchester and its suburbs did not number 20,000, whilst 500,000 will at the present moment be no incorrect estimate; and this single fact must prove the potency of mechanical skill, and the success of manufacturing and mercantile energy there exerted. Extensive are the ramifications of the manufacture of cotton, and numerous are the places in which it has become the great support of labour. In addition to Lancashire, Cheshire, and Derbyshire, where large spinning and manufacturing concerns exist, there has been established in Scotland a branch of the trade of great importance; and in that portion of the United Kingdom the investments of capital are considerable, and the trade there affords profitable employment to multitudes of workpeople in almost every department of its industry. From north to south and from east to west in Great Britain are to be found seats of this manufacture. In many parts of Yorkshire cotton is spun; but in Bradford and other places cotton yarns and thread are extensively and advantageously blended with the wool of the sheep and of the alpaca, jointly producing most useful and beautiful fabrics. At Nottingham the lace trade has taken up its abode, whence it extends to Devonshire and to the Isle of Wight. Leicestershire possesses the

hosiery trade; and thus from place to place cotton has wandered, as a benefactor and not as a vagrant, and has been manipulated according to the genius of the people who have seized hold of it, and to the demands and taste of the age. The beautiful art of printing calicoes and muslins is chiefly conducted in Lancashire, but in Scotland it is also a large and important branch of industry. About one-eighth of the cotton spun and manufactured in the United Kingdom is devoted to this portion of the trade. The workpeople employed in printing are very numerous, and are exceedingly well paid. To the art of printing the cotton trade and the consumers of its manufactures are greatly indebted. No goods produced combine the beauty of coloured decoration with excellence of fabric, at so small a cost, as do printed cottons. Depending, as this country now does, upon cotton as an article by which labour and capital are most extensively sustained, as the leading commodity of import and of export, as affording more employment than any other material of manufacture, having involved in it the welfare and happiness of greater numbers than any other single industry, and contributing by the payment of direct and indirect taxes most essentially to the national revenue —may not the question be asked whether this foreign raw material be so efficiently supplied as to prevent those fearful disasters which would arise to the labouring, trading, and mercantile classes, if by storm or tempest, by revolt, or by the calamity of war, this vital element of prosperity could not continue to be procured from its present field of greatest growth? To the energy of the planters of the United States this industry is more indebted than to the cultivators of land in any other country; yet the States possess only an insignificant portion of ground capable of growing cotton as compared with the vast tracts of excellent soil in suitable climates which are under the dominion of this country. Beyond the possessions of Great Britain are equally extensive fields in which cotton could be cultivated and produced. Africa and Asia could grow more cotton than the most sanguine can contemplate the demand of the whole world will ever require, and to extend its production in those two quarters of the globe would be at the same time to extend civilisation, and to diffuse the comforts of life. Workpeople, manufacturers, merchants, statesmen, and philanthropists, have all the deepest interest in this vital question, but which hitherto has been shrouded in almost fatal apathy. Cotton, sheeps' wool, flax, and silk are alike required in larger quantities to supply the calls of industry, and to contribute to the manufacture of goods for which the wants of mankind induce them to crave; and a true benefactor to industry will he be who promotes the growth of those raw materials, without an increase of which trade and commerce will languish; but in truth their scarcity and consequent dearness of price will define and limit the extent of manufacturing industry in every branch; therefore, a great duty devolves upon all who wish prosperity to be perpetuated, and who desire the continuance of well-rewarded labour. At home and abroad the wonder is that the British East and West Indies have not supplied the largest portion of the cotton needed in this country; but the lust of conquest in the rulers of the former dependency, and the prostrate condition of its population, arising from exactions which even few conquered nations have submitted to, have tended to retard the extension of the cultivation of cotton, and of other valuable products such as its soil and climate would permit to be cultivated with advantage; and in the latter, the West India islands, deadly protection misdirected the energies of their planters, and when the legislature emancipated the negro no provision was made for the introduction of free labour; wherefore misgovernment is responsible for much of the unproductiveness of those portions of the British empire. Roused, however, by the salutary influences of public opinion, the Legislature of our country has given to the East Indies a new existence. No intermediate spoiler will hereafter prevent the Queen and a direct executive from developing the resources of India. Abounding in the elements of prosperity, the soil, climate, and people afford pledges of success, if roads, canals, railways, telegraphs, and the other agencies of progress be introduced; but above all, if that beneficent principle by which nations can only advance with enduring certainty be recognised in the administration of pure and untarnished justice; the future of our two hundred millions of fellow-subjects will be identified with their amplest productions and the largest commerce of the world; with civilisation untainted by the errors of superstition—a false philosophy, and our common Christianity will be received and embraced as the triumph of Britain's gracious rule. An enlightened and just policy applied to every British colony will yield the benefits of an extended commerce, blessing, like charity, those who give and those who receive, whether at home or in the foreign dependencies of Great Britain. Laws to be respected and obeyed must be just, and no system of polity can be permanent unless the material prosperity and welfare of the people under it be secured. For a moment contrast the course of industry in Lancashire, the great manufacturing and consuming district of this very cotton, with the East Indies, the country pre-eminently capable of supplying it in overwhelming quantities. In the one case from the battle of Plassy, 100 years ago, we have witnessed annexation upon annexation, oppression in taxes and rents, roadless and impassable territorial possessions, agriculture retarded, irrigation and public works discountenanced, justice frustrated, Juggernaut and the suttee long upheld to the perpetuation of superstition: and, finally, this ruling policy bore the fruit of which it had sown the seed—mutiny and its consequent horrors. In the other case, Lancashire during the same period has increased to an untold extent in the value of its landed and other property, in the numbers of its inhabitants, in its services to the State; and it has surmounted difficulties, natural, commercial, and governmental, thereby acquiring prosperity unprecedented. Of the moral and educational state of the workers in cotton manufactories it may be asserted that they are less the victims of vice and ignorance than are many of the labouring classes in some semi-domestic and other trades. No doubt the educational qualification which the law requires for children employed in factories is of great benefit to them; but this imperfect system of partial national education is invidious as applied only to children who labour in factories. Could, however, all the children in the United Kingdom derive the instruction afforded to those of them whose destiny places them in mills and manufactories, fewer would be the evils which are indentified with ignorance. On this occasion time cannot be allowed to illustrate by other details the state and progress of the cotton trade; but the multitudinous advantages which have proceeded from this industry are in truth kindred representations of the benefits which have been derived from the great manufacturing and mercantile organisation of this country. In the manipulations of wool, flax, silk, and of all the metals are to be found proofs as important as those claimed for cotton that the modern manufacturing system by which the comforts of life are indefinitely increased, is, under a wise Providence, raising the moral, mental, and social condition of people everywhere, and is placing the necessaries and elegancies of life within the grasp of countless classes, to whose predecessors such comforts were unknown. Evidence has now been adduced that the sustaining, clothing, and material comforts of life have been vastly increased, whilst literature, advancing with the age, has contributed to the mental elevation of the whole community. Under the old feudal system of the country the labouring classes had inflicted upon them privations and indignities which now they are no longer called upon to endure; they maintain their personal independence; and where, by mental attainments, industry, frugality, honesty, and perseverance, they strive for fortune and distinction, no hindrance to their

advancement exists. That the improved cultivation of the earth and mechanical applications to manufactures have added immeasurably to the ability of all to consume more largely, than at any former period of the surrounding plenty, created by intelligent industry, none will deny; but if a link in the chain of that plenty which now exists be required, look to the burthens of abundance freighted on the fleets of merchant ships, which traverse every sea, and which the wind and wave send as messengers of plenty and peace to the people of every land; see our shores fringed with the sails of every nation; see our old roads still loaded with the fruits of the earth and of toil; canals, their slow rivals, engaged in the performance of similar labours; then mark the progress of steam's rapid car, bearing on the railway those precious loads of human life, and that traffic which cannot wait for the locomotion of olden times; and, finally, see that despatch of weal or woe which heaven's lightning, made to drudge, sends from man to man, and bold will be the sceptic who disbelieves in the ameliorations of this age, prolific in practical benefits. Acknowledging, therefore, the existence of superabundance in everything which can promote the comfort and happiness of mankind, is its distribution directed to the reward of those who toil and spin? In every age of the world, rich and poor have existed, but the latter in modern times have diminished in proportion to the visible increase of the former; and when nature and art are in beneficial alliance, increasing the store of material comforts, these being produced beyond the possible consumption of the affluent, their surplus can only be absorbed by those whose reasonable wants need and deserve to be supplied; and, therefore, the rich who have always had the means of procuring enough, and requiring little of the increase, the masses of our fellow-creatures, who earn wages by their labour, are in reality the great buyers and consumers of the bounties which their labour provides. In days of yore, when manufacturers had no existence here, the rich procured their foreign luxuries by unholy traffic, and Britain's children were stolen and sold to bondage; yet then, as now, the wise and beautiful were amongst the daughters of our race, and from the expatriated of those their sprang a Queen who graced the throne of the great Constantine; but in these better days no tender ties are severed by us to procure wares which in our time honest labour buys. Later in the progress of early traffic our nobles obtained their Genoa velvets and their Damascus swords by the exchange of that corn which their estates grew, but which their hungry dependents could have devoured; though now neither feudal nor fiscal violence need disturb the self-adjusting commerce of nations, nor the laws of exchange interfere with the relative values of those commodities which men give and take from their fellow-men. With these facts illustrative of the power, utility, benefit, and enlightening influences of trade and commerce, may not the conclusion be sanctioned that industry and exchange are amongst the true auxiliaries of civilisation and comfort. When therefore we see our globe girt with the intelligence which intercourse diffuses; when the soils and climates of the earth are devoted to the production of materials which are indispensable to the industry and comfort of mankind; when genius and talent, guided by philosophy, prepare for the most effective application to useful purposes those materials; and when patient and enduring labour at home manipulates the gifts of nature grown in distant lands—can the good and practical result of man's exertions be otherwise than beneficial to his fellows of every country; but when the telegraph, steam, and other mechanical wonders are rendered subservient to the benefit of man, no other than grateful homage to the ever present though invisible Power which sustains the universe can animate those who would still advance and elevate the intellectual and physical condition of their species. On the recent visit of our gracious Queen to her loyal town of Leeds, the progress of our town and the pecuniary and accumulative prospects of commerce were referred to, and in those visions of brighter days and developments which were then anticipated may the gladdening aspiration predominate that moral and mental attainments shall never be subordinate to mere material acquisitions. And may the British Association in its migrations scatter the seeds of progressive and practical philosophy, aiding by its wisdom, correcting by its knowledge, and encouraging improvements by its discerning approbation, till the light of truth banish the darkness of error and ignorance; and thus may an enduring alliance of the advantages of science be cemented with the practical benefits of trade and commerce.

TONNAGE REGISTRATION.

The Report of the Committee appointed by the British Association to inquire into this subject, was brought before Section G. at Leeds, when the following resolution was passed:—

"That the Report of the Shipping Committee be sent to the Council, accompanied by such a statement as the members of the Shipping Committee who declined to act on that Committee may think fit to prepare. Such report and statement to be dealt with as the Council may think fit."

Under these circumstances it has been thought right not to publish the Report at present.

CONCERNING JAMES WATT.

The copy of an original letter from James Watt to a Mr. Geo. Mackay, on the subject of the steam-engine, mill, and machinery, subsequently erected for the Governor and Company of the British Cast Plate Glass Manufacturers, at the head of which was Sir Herbert Mackworth, the locale being Ravenhead, near Prescot, in the County of Lancaster, and the rough draught of agreement, dated Sept. 1, 1788, just seventy years ago, have been shown to the Secretary, who has received permission to publish the following particulars. The letter is given entire:—

Birm^m^ Oct^r^ 20^th^ 1788.

Mr. Geo. Mackay,

Dear Sir,

We have made out plans for your Engine house & Mill House, which will be sent of by Tuesday or Wednesday. We have not been yet able to settle the Machinery, but have settled it so far as relates to the millhouse. The method propos^d^ with the long rod moving the whole length of the house did not please, we have therefore provided for a long shaft as propos'd first. I have also some reason to think the oval motion may not answer but have made the house that it will answer for either way. You will see that I have propos'd the polishing shop to be next to the road wall and the grinding shop to be next to the Salt Houses, with the Engine house as near the edge of the bank as you shall judge convenient. and the angular piece left may serve for a coal yard.—As for the method of Polishing it is far from being settled. I think you will do well to build the grinding shop and Engine house first and set that agoing before the other is begun, by which means we will be enabled to try experiments on the proper means of polishing, before we lay a brick of the polishing shop. you will please advise whether you begin building this season or delay till the spring. I am going from home for a week but shall write again when I return. I remain Dear Sir

Your Obed^t^ Hum^e^ Serv^t^

JAMES WATT.

It appears by this letter that the whole arrangements of the Glass Works was left to Mr. Watt, for the agreement was entered into about a month before the date of this letter, when he had still to settle how glass might best be polished by a course of experiments, thus clearly proving the great trust that was placed in his skill, and his great caution, which warranted the trust in him. A subsequent note is as follows:—

"Messrs. Boulton and Watt present their compliments to Mr. Black, and have sent the deeds of agreement betwixt the Glass Company and them for the Company's seal, and have advised Sir Herbert Mackworth, Bart.

"Birmingham, 7th October, 1788."

By the rough draught of the agreement it appears that a licence was given to the Company to erect and use one of his engines capable of raising 47,000 pounds weight ten feet high in one minute, being estimated as equal to 14 horses power, for the remainder of the term of 25 years, granted by Act of Parliament in consideration of an annual payment of £70, and the said engine was not to be used at any other place than Ravenhead, or within ten miles distance therefrom.

There is an endorsement on the margin of the rough draught thus:—

"1788
Sept[r] 24
Approved H. M."

being the initials of Sir Herbert Mackworth.

There is also a curious annotation in it, a direction to the clerks,—

"The parchment to be turned up 2 inches."

Amongst the documents is another note, apparently for the purpose of formality in business, probably from the solicitor of Messrs. Boulton and Watt.

Birmingham, 7th October, 1788.

Sir,—By the coach this evening will be sent to Mr. Black the deeds of agreement betwixt the Governor and Glass Company and Messrs. Boulton and Watt, executed by the latter gentlemen. When the Company's seal is put to them, one is desired to be returned.

Sir, your most humble Servant,
JOHN SOUTHERN.

Sir Herbert Mackworth, Bart.

Accompanying the papers is a rude specification of the boiler, dated 17th October, 1788. "The man-hole is oval, 18 inches by 14, without a lid; the bottom is to be made of copper, 12 lbs. to ye square foot; the sides of copper, 9 lbs. to ye square foot; and ye top of copper, 6 lbs. to ye square foot." 6ft. 6in. in diameter, 7ft. 6in. in height, 6in. flat on edge, with the bottom to rest on the brickwork, and a hollow rim of 9in. along the bottom to catch the heat.

"Dimensions, both as to diameter and height, and also as to thickness of ye metal, to be strictly adhered to."

"N.B.—Ye top is half a globe."

Nothing is said about length. The thickness of metal is rather startling at the present day; the bottom about $\frac{1}{4}$ inch, the sides $\frac{3}{16}$ inch, and the top about $\frac{1}{8}$ inch. But working pressures then were only 7 lbs. per square inch; some difference from our modern locomotive pressures at 120 lbs. per inch. The wooden cask, with hoops, found in one of Mr. Watt's patents, for a locomotive boiler, with a fire in its belly, though a very original idea, would scarcely fulfil our modern conditions.

The first of Mr. Watt's engines to produce rotary motion was erected in 1787. The engine, the subject of the present article, appears to have been his second, and his profit for royalty was £5 per horse-power per annum for 25 years; thus, £1750 was the royalty on his second engine, distributed over a period of 25 years. It seems now a large payment for a 14-horse engine, but it is doubtful if our progress as a nation would have been hastened so rapidly had the legislature grudged the reward to our great inventor, as did his competitors after the fact was achieved.

It may be added that the above machinery for polishing glass has been in use continuously from 1788 to the present date, almost without alteration. New machinery is now being erected.

ELECTRIC TELEGRAPHS.

The Vienna correspondent of the *Times*, under date of the 27th instant, relates the following occurrence:—

"An accident which happened a few days ago at Zara (capital of Dalmatia, on the coast of the Adriatic sea) may, perhaps, serve as a warning to persons who are employed in repairing telegraphic wires. After a violent thunder-storm, accompanied by heavy rain, some workmen attempted to raise two or three posts which had been thrown down. Two of the men took hold of the wire, which was not broken, in order to assist their comrades, but hardly had they touched it when they uttered piercing screams. The one man staggered, and fell to rise no more, but the other remained on his legs. A third man, who was struck by his falling comrade on the shoulder, complained of violent pains in the head, singing in the ears, and indistinct vision. The hands of the two men who had taken hold of the metal were much burnt, and the one who escaped with his life stated, that as soon as he touched the wire he suffered 'indescribable' pains in the head and body."

SOUTH KENSINGTON MUSEUM.

During the week ending 25th Sept., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 4,150; on Monday and Tuesday (free evenings), 5,532. On the three Students' days (admission to the public 6d.), 619; one Students' evening, Wednesday, 96. Total, 10,397. From the opening of the Museum, 612,548.

Proceedings of Institutions.

Glasgow.—The thirty-fifth annual report of the Mechanics' Institution for the session 1857-58 speaks of its increasing usefulness and prosperity. Last year the Institution received a grant of £200 from the Ferguson bequest fund. Of this sum £150 was applied toward payment of the debt secured over the property, and the remainder was voted for the purchase of books for the Library. The number of students enrolled in the classes of the Institution was 887, being 140 above that of the previous session. In addition to the usual courses of instruction, morning and evening French classes were instituted and very successfully conducted. The abstract of the treasurer's accounts shows a balance of £70, remaining available for the objects of the Institution. The report then enumerates some presents which have been made to the Institution, and then proceeds to give an account of the various branches of instruction which are taught there. In chemistry, the teacher, Dr. Wallace, devoted the course to the consideration of the fundamental principles of this important branch of natural science, together with the study of the chemical history of the non-metallic elements and their most important compounds. Monthly examinations were held, for the purpose of ascertaining the progress made by the students and of awarding the Prizes. The Lecturer has expressed great satisfaction with the diligence and progress of the students. The course on natural philosophy, by Dr. Thos. Johnston, consisted of a series of lectures on the leading heads of mechanical philosophy, illustrated occasionally by experimental exercises. The capabilities of the students were tested, both by the writing of essays and verbal answers to questions proposed from time to time by the lecturer, on the subjects taught. In the class for music, the teacher, Mr. Barr, was occupied during the first half of the session principally in giving the students a through knowledge of the various characters used in music, and of singing at sight, in which very satisfactory progress was attained. The second half of the session was taken up in practising the singing of psalm tunes, glees, and popular songs. The lecturer was enabled to make advances with the theory of harmony to a greater extent than on any former occasion in the Institution, owing to a number

of the students having attended during a previous session. The elocution class was conducted by Mr. G. M. Ferrier, L.R.C.S., and although this gentleman had the disadvantage of commencing late in the session, and of this being his first appearance in the Institution, he obtained a large class. The course consisted of twelve lectures. The principles of rhetorical reading were explained. Pronunciation and the different kinds of emphasis, as applied to expressive reading, were illustrated by vocal exercises. The French classes, conducted by Mons. C. A. Chardenal, B.A., were in three divisions,—two in the morning and one in the evening. The number of tickets sold was 128. The books used for beginners were "Hall's first and second courses of French Lessons," which were gone through by both classes of beginners. For the advanced class, which met at eight o'clock in the morning, the half of "Holt's Genius of the French Language" was gone over. The teacher recommends this work, for its excellence in French idioms and conversational exercises. He was well pleased with the attention and progress of all the pupils. The classes conducted by Mr. H. M. Ashcroft, for instruction in the higher branches of Arithmetic and in Mathematics, have increased considerably, 164 tickets having been sold. The students in this department were arranged into junior, middle, and senior classes. The junior class was occupied with the study of the first and third books of Euclid's elements; Algebra—as far as simple equations with one unknown quantity; Mensuration of superficies, and some of the rules of Arithmetic. The middle class studied the first and third books of Euclid minutely, the second algebraically, the fourth cursorily; Thompson's supplement to the fifth, some of the more important propositions of the sixth; plane Trigonometry; Mensuration of heights and distances, with the use of logarithms; Mensuration of surfaces and solids, and most of the rules of Arithmetic, from proportion onwards. The senior class studied: In Algebra,—all the subjects treated of in Montgomerie's Algebra: In Mensuration,—surfaces and solids, and some of the conic sections: In Euclid,—the six books, (Dr. Thomson's supplement to the fifth being used instead of the ordinary fifth book): In Trigonometry,—the analytical investigation of the formulæ for the different cases, and for the computation of tables of sines, tangents, secants, and others; and the application of these formulæ, simplified by logarithms, to the solution of various problems in navigation and mensuration of heights and distances: In the calculus,—the differentiation of Algebraic functions, maxima and minima, equations of straight and curve lines, and the elementary rules of the integral calculus. Upon all those subjects, numerous exercises were prescribed, and written solutions of them handed in weekly. With few exceptions, the attendance of the students upon the different classes was exceedingly regular, and the diligence and progress of all were highly satisfactory. The class for mechanical drawing, under Mr. Robert Harvey, has greatly increased. The pupils were chiefly engineers and tradesmen of mechanical professions. Mr. Harvey delivered his usual lectures on the more important details of the steam engine and applied mechanics, which were illustrated by a large collection of diagrams, and by models from the museum of the Institution. In the class for Drawing, Painting, and Perspective, conducted by Mr. A. D. Robertson, beginners were instructed in geometrical and elementary drawing of ornaments, flowers, figures, &c., having the general principles of perspective and the characteristic differences of Greek, Roman, and Gothic architecture and decorations explained to them. The students of the class for the study of trees and landscapes have made the most satisfactory progress, and those of the architectural advanced class have given the utmost satisfaction—the subjects of study being the classic, Doric, Ionic, and Corinthian orders. The students who studied perspective have shown an intimate and thorough knowledge of this most essential branch of art. The Botany class, under Mr. Roger Hennedy, consisted of 48 members. This interesting branch of natural science was highly appreciated by all the students. Excursions were made to various localities, thus giving the students opportunities of examining an extensive variety of plants and flowers with pleasure. The meetings of the Mutual Instruction Class have been held once a week. The debates and essays are, under certain rules, conducted by the students, without the interference of the Directors. The essays and subjects for debate amount to 34, and 22 students are engaged as principles. In the classes under the charge of Mr. Craig, the number of pupils and students has been from 1st May, 1857, to 14th April, 1858,—in the public day classes, 187; private day classes, 29; in the grammar and logic evening class, 176; in the arithmetic and book-keeping class, 204; and in the Phonography class, conducted by Mr. Stevenson, 58. The directors have lately purchased a considerable number of books, on science, art, and literature—these books have been placed in the library, along with those received from donors; the number of volumes amount to 6,300.

Portsea (Watt Institute).—On Thursday evening, the 23rd September, the members of the Portsea Watt Institute assembled in the Society's Hall to do honour to the two young men connected with that Institution who distinguished themselves in the late Society of Arts examinations, and who were then to receive the Certificates of Merit given to successful candidates by that Society. A tea was provided by the Committee of the Watt Institute, the more important business of the evening following.—W. Hamilton, Esq., Paymaster of H.M.S. Excellent, President of the Philosophical Society, presided, and representatives of the three local institutions, in connection with the Society of Arts, were present. The Chairman said they were met for the very interesting purpose of congratulating on their success the two candidates from the Watt Institute who had received certificates from the Society of Arts, and whom he had great pleasure in introducing to their notice. The gentleman on his right (Mr. Wicker) succeeded in obtaining the first prize, and he (Mr. Hamilton) was happy to say that he had the good fortune to be in London, and to be present at the public dinner given to commemorate the meeting of the Society of Arts. The Earl of Carlisle was in the chair, and he felt exceedingly gratified at the manner in which that nobleman brought Mr. Wicker before the notice of that meeting. He was sure that Mr. Wicker would recall that circumstance of his life with the greatest pride and interest, as long as he lived. But if he felt gratified on that occasion when he was brought to the notice merely of an assemblage of gentlemen, he was sure that gratification would be doubled when he saw so many bright and pretty eyes expressing their approbation. He was sure he should only vex them if he detained them with any remarks on the advantages of education; he would, therefore, do no more than offer to the gentleman on his right the sincere and hearty congratulations of the company present, for the success which they had achieved in that high and honourable examination which they had been called upon to pass, and express their sincere and heartfelt wishes that the bright example they had furnished might inspire the minds of many of their fellow members to imitate their example.—The Rev. Professor Main, of H.M. dockyard, said, it had fallen to his lot, as Chairman of the Local Board of Examiners, to hand over to the successful candidates before them the certificates of merit so honourably acquired, and he did hope that their example would stimulate others who were coming on. They had furnished two candidates this year, both of whom were successful, and were a credit not only to the Watt Institute, but also to the town to which they belonged, and he hoped their example would be followed by many others not only of that Institution but also of other kindred Societies in the borough, and that

Portsmouth would still sustain the name which she enjoyed in common with other towns. The duty of examining gave them some little trouble, but he could assure the meeting they did it with pleasure, because they had a desire for the welfare of those around them, and if the numbers increased ten or twentyfold they would consider the labour required on their parts for the preliminary examinations well bestowed. He expressed the pleasure it afforded him to present the certificates which had been so honourably earned by Mr. Wicker. The first was the first of the three degrees of merit for arithmetic, algebra, and mensuration. In addition to this certificate, for his proficiency in arithmetic he received £5, for his proficiency in algebra, £5, for his proficiency in mensuration, £5. The second certificate was the second of the three degrees of merit in geometry, statics, dynamics, hydrostatics, and practical mechanics. The third certificate was the third of the three degrees of merit for trigonometry. To obtain these, Mr. Wicker must have devoted to his studies that time which others spent in what they considered to be a more agreeable manner, and he must have exercised considerable self-denial in that respect. He had great pleasure in offering him his congratulations. Addressing himself to Mr. Smith, Professor Main said he had also the pleasant task of handing him two certificates, the first being the second of the three degrees of merit in geometry and trigonometry, and the second, the third of the three degrees of merit in arithmetic, mensuration, statics, dynamics, and hydrostatics. He hoped this would stimulate him to further exertions, and he had much pleasure in offering to him also his congratulations.—Mr. Wicker on rising was received with much applause. He said that if he were to receive these certificates without any acknowledgment, they would think him unmanly and ungrateful, yet when he informed them that this was his first appearance in public, they must excuse the embarrassment he must necessarily feel. He had great pleasure in receiving the certificates at the hands of Mr. Main, and he hoped that he and Mr. Smith would not be the last to whom certificates would be awarded in this place, but that in each succeeding year more and more candidates would be successful in the Society of Arts Examinations. He felt himself unworthy of the honour they had done him that evening in giving him such a hearty welcome, and as he did not wish to forfeit their favour by a long speech, he would only express to them his sincere thanks for the same.—Mr. Smith was also received with much applause. He said he tendered to them his grateful thanks for the encouragement that he and Mr. Wicker had received from them that evening, and to those of the same age as himself who had an inclination to present themselves at the examinations, he would say that he believed the name of the examination to be its most difficult part; if they would only apply themselves to study with earnestness and perseverance, and if they would give their time and trouble to prepare for these examinations there was no doubt they would find themselves in the position of Mr. Wicker, and obtain similar high certificates.—The Rev. H. Hawkes proposed a resolution to the effect that the meeting expressed its cordial good-will for the Society of Arts, and its approbation of the exertions it was making to promote the free diffusion of useful knowledge, in order to stimulate young men to self-education. He expressed his gratification at the successful results of the labours of the young men before the meeting and his cordial approval of the work undertaken by the Society of Arts. He more especially adverted to the fact that prizes had been gained by young women at the recent examinations, and dwelling upon the influence of women in their several relationships, in forming the character of men, showed how it was important that they, too, should be educated.—Mr. Spence, in seconding the proposition, entered into details with reference to the Watt Institute. After describing the cause which led to the establishment of that institution in 1848 by the factory operatives, he described, from a prospectus which accidentally fell into his hand a few hours before the meeting, the state of the institution in 1849. Its classes at that time were very flourishing; the drawing class numbered 15 members; the reading class, 9; arithmetic, 20; writing, 24; natural philosophy, 18; algebra and geometry, 16; junior steam class, 20; senior ditto, 20, and singing class 26. Mr. Spence also briefly traced the work of that society since that year, and stated that it was still pursuing its labours in the same spirit. After stating that the financial condition of the Society was very encouraging, there being a balance in the hands of the treasurer, Mr. Spence entered into various details to show the importance and the fruits of unflagging industry in the work of self improvement, and made other remarks to encourage those who were working like Mr. Wicker and Mr. Smith.—Mr. Ubsdell spoke to the sentiment: "The Fine Arts, may they become universal." Mr. Ubsdell briefly detailed the benefit arising from the cultivation of the Fine Arts, the recent rapid strides of our countrymen in this direction, and the opportunity afforded by the Athenæum classes conducted by Mr. Cunliffe, for students to obtain that instruction which was necessary to enable them to compete with credit at the Society's examinations. He expressed himself willing to give every assistance for the promotion of the object in view, and urged upon parents and guardians, and the youth of the borough, the importance of taking advantage of the facilities thus offered them for the acquirement of a knowledge of the Fine Arts.—W. Rawson Esq., of H.M. dockyard, expressed the great pleasure he felt at being present on that occasion, one of the successful candidates having been for 8 or 9 years to a certain extent under his charge, and the other for a period of 5 or 6 years. He perfectly coincided with Professor Main not only in his congratulations to the young men before them and to the institution with which they were connected, but also in his congratulations to the town to which they belonged. But these were not the only prizes Portsmouth had carried off. There were in the town two men who had gained the highest mathematical honours in the Universities. One was Professor Main, and the other Mr. Besant, both of whom had reached the high and noble position of Senior Wrangler of Cambridge University. Others, too, who acknowledged Portsmouth as their birth-place, had obtained distinguished honours. It was therefore his fervent desire that the success which had attended the mental exertions put forth by the two young men before them, might influence them in all their after-life, and that it might induce others to follow in their footsteps. Mr. Rawson then said a few words on the sentiment, "The memory of James Watt," showing the nature of his great work, and the connection between him and other great men of our country, and concluded by pointing out the only way by which success could be ensured in the pursuit of knowledge.—The Rev. W. Young spoke on the sentiment, "The education of the young, may it become universal, and based on broad and sound principles, common to all sects and parties."—Mr. Charles Maxwell gave an interesting and humorous *résumé* of the life and writings of Thomas Hood, with quotations from the latter; and a vote of thanks having been given, which was duly acknowledged, the meeting separated.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Sept.* 17, 1858.]

Dated 7th September, 1858.

2025. G. Larsonnier and A. Blanche, Paris—Imp. in block-printing by hand on tissues, paper, or other suitable fabrics.

Dated 8th September, 1858.

2027. B. Hockin, Gateshead Iron Works, Gateshead-upon-Tyne—Apparatus for repairing and fitting dock-gates and their machinery.

2029. J. O. Butler, Kirkstall Forge, near Leeds—Imp. in weighing cranes. (A com.)
2031. A. Lamb, Southampton, and J. White, Cowes—Imp. in life-boats.
2033. C. Bartholomew, Rotherham, and J. Bell, Swinton—Imp. in pistons and safety-valve levers of steam and other engines.
2035. J. U. Faessler-Petzi, Lyons, France—An improved process for the boiling off of tussah silks or wild silks.
2037. A. M. Peters, Edinburgh—Imp. in apparatus for regulating the flow or passage of fluids.

[*From Gazette, Sept.* 24, 1858.]

Dated 14th July, 1858.
1578. E. J. Maumené and L. B. Jaunay, Reims, France—An improved method of, and apparatus for, the production of sparkling wines.

Dated 24th July, 1858.
1673. H. Wikoff, Holly-lodge, Kensington gore—An improved aperient medicine to be used in the shape of a biscuit, cake, or sweetmeat. (A com.)

Dated 29th July, 1858.
1712. A. Gallard, 58, Aldersgate-street.—A new system of trusses. (A com.)

Dated 14th August, 1858.
1864. L. A. Forot, 2, Rue Sainte Appoline, Paris—A new mode of ornamenting fabrics, and in the apparatus connected therewith.

Dated 21st August, 1858.
1903. M. Benson, Craven-street, Strand—Improved apparatus for generating steam. (A com.)

Dated 23rd August, 1858.
1912. C. Buono-Core, Naples—A liquid or composition which when applied to substances of any kind will render them fire-proofs or uninflammables.

Dated 26th August, 1858.
1934. J. Coates, Lower Shadwell—Imp. in apparatus or machinery for obtaining and applying motive power.

Dated 6th September, 1858.
2012. T. Warburton, Astley, near Manchester—Imp. in machinery for preparing cotton and other fibrous materials, and for doubling yarn.
2016. R. A. Brooman, 166, Fleet-street—Imp. in printing or marking words or figures on papers, parcels, books, pages, tickets, and other articles requiring to be marked, printed, stamped, or addressed. (A com.)

Dated 7th September, 1858.
2018. J. Shanks, St. Helens, Lancashire—Imp. in the manufacture of chlorine.
2020. J. Fyfe, Greenock—Imp. in stop cocks or valves.
2024. F. W. Brind, 14, Devonshire street, Bishopsgate—Imp. in sewing machines. (A com.)
2026. L. Pellissier and J. Puytorac, Bordeaux, France—Imp. in railway breaks.

Dated 8th September, 1858.
2028. J. R. Rostron, Edenfield, Lancashire—An improved press for packing or pressing wool and other materials.
2030. J. F. Dickson, 6, Russell-street, Litchurch, near Derby—Imp. in the construction of taps, cocks, valves, hydrants, and other apparatus for regulating the flow of water and other fluids.
2032. W. Parsons, Pratt-street, Lambeth—Imp. in apparatus to be applied to steam-boilers, in order to keep the surfaces of the tubular flues free from incrustation.
2034. W. Parsons, Pratt-street, Lambeth—Imp. in safety valves of steam boilers.
2036. R. A. Brooman, 166, Fleet-street—An imp. in the preparation of sulphate of quinine.

Dated 9th September, 1858.
2038. J. G. Newberry, Cardiff—An improved machine for tapping nuts, bolts, and screws, and other similar purposes.
2039. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved life-preserver raft of buoyant mattress. (A com.)
2041. J. Rowley, Grosvenor terrace, Camberwell—New compound material applicable as a substitute for leather and leather cloth, in the manufacture of various useful and ornamental articles.
2043. C. N. Kottula, Liverpool—Imp. in the manufacture of grease for lubricating purposes.
2044. J. Tatlow and H. Hodgkinson, Wirksworth, Derbyshire—Imp. in railway breaks.
2045. T. Timms, 1, Skelton-street, Greenwich—Imp. in bits.
2046. J. Wright, senr., and J. Wright, junr., Market-place-terrace, Caledonian-road, Islington—Imp. in machinery and apparatus used for preparing fabrics or materials to receive eyelet holes or fastenings, and fixing eyelet holes, and in fastenings for stays and other articles.
2047. W. Nimmo, Manchester—Imp. in weaving checks in power-looms.
2048. A. Baader, junr., Mittenwald, on the Isar, Bavaria—Imp. in the preparation of lubricating compounds.
2049. W. Clark, 53, Chancery-lane—Imp. in materials for dyeing and printing. (A com.)

Dated 10th September, 1858.
2051. J. Parker, Bradford—Imp. in steam boilers.
2053. J. P. Kœnig, Rue de Fleurus, Paris—Imp. in a surgical instrument called a pneumatic catheter.
2055. F. W. J. Johnson, London—Improved means of communicating between the passengers, guard, and engine-driver on railway trains.
2057. W. E. Newton, 66, Chancery-lane—An imp. in water-wheels. (A com.)
2059. W. Toshach, Railway Works, Bristol-road, Gloucester—Imp. in pile-driving machines.

Dated 11th September, 1858.
2061. L. Hill, Port-Glasgow—Imp. in apparatus for lowering or paying out ships' chains and anchors.
2063. F. Giesbers, Great Central Gas Works, Bow-common—Imp. in the manufacture of coke.
2065. H. Page, Whitechapel—An improved crown or round glass, and apparatus for manufacturing the same.
2067. H. Wikoff, Holly-lodge, Kensington-gore—A new tonic medicine, for the cure of coughs and diseases of the chest. (A com.)
2069. L. Kaberry, and T. Mitchell, Rochdale, Lancashire—Imp. in machinery or apparatus for preparing for spinning, and spinning cotton, wool, and other fibrous materials.

Dated 13th September, 1858.
2071. W. Thomson, Manchester—Imp. in bleaching yarn, warps, or similar materials.
2073. J. B. A. Dugléré, Paris—A new method of separating solids from liquids for disinfecting purposes.
2075. S. Hanbury, Birmingham Patent Iron and Brass Tube Company, Smethwick—An imp. in the manufacture of tubes of copper, brass, and other metals.
2077. J. Turner, Gresham-street—Imp. in the manufacture of hats.

Dated 14th September, 1858.
2079. C. J. Redpath, Limehouse—Imp. in ships' and other pumps.
2081. L. Vidie, Paris—Imp. in apparatus for measuring the pressure of fluids by the flexion of diaphragms.
2085. G. C. Grimes, Wandsworth—Imp. in fusees, and in the means of manufacturing fusees.
2087. A. H. J. Bastable, Belgrave Works, Ranelagh-road, Pimlico—Imp. in apparatus employed in the production of light. (A com.)
2089. Hon. W. E. Cochrane, Osnaburg-terrace, Regent's-park—An imp. in the fastening of railways.

Dated 15th September, 1858.
2091. E. Smyth, Brixton—Imp. in swimming belts and life-preservers.
2093. W. G. Taylor, Ashby de-la-Zouch, Leicestershire—Imp. in the manufacture of gloves.

Invention with Complete Specification Filed.

2098. J. R. Scartliff, Wolverhampton—An improved burglar's detector.—17th September, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Sept.* 24, 1858.]

September 22nd.
591. E. J. Manwaring.
600. H. L. Muller.
604. J. Rowbottom and T. Standeven.
610. C. F. Quintin.
612. J. C. Wilson.
614. H. Gerner.
621. J. F. Brinjes, junr., and H. J. Collins.
622. W. and R. Wood.
623. J. V. Hielakker.
624. A. L. Thirion.
627. W. Crook.
645. H. Doulton.
653. J. Welch.
668. W. Davis and T. Harper.
670. F. Robinson & E. Cottam.
695. F. R. & J. A. F. Tavernier.
715. S. Minton & R. H. Thomas.
792. H. Whittles, J. Schofield, E. Leach, and J. Lord.
885. M. Henry.
905. J. Maitre.
1006. J. Whitley.
1178. J. Luis.
1552. W. E. Newton.
1592. C. W. Williams.
1600. P. Fairbairn.

[*From Gazette, Sept.* 28, 1858.]

September 25th.
634. J. Young.
635. W. Robjohn.
636. F. A. Chevallier.
637. R. A. Brooman.
638. W. Moxon, J. Clayton, and S. Fearnley.
642. R. M. Butt.
647. J. and J. F. Newman.
650. J. Bushell and T. Wright.
654. J. A. V. Burg.
656. F. Bousfield.
661. J. F. Spencer.
664. J. C. Durand.
665. I. and J. Brown.
669. W. Harding.
671. J. C. Durand.
672. W. Weallens.
696. F. J. E. Oosterlinck.
700. T. Boardman & J. Allcock.
714. E. Edwards.
1593. R. Brazier.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Sept.* 24, 1858.]

September 13th.
2125. W. Pollitt and J. Eastwood.
2191. J. R., R., and J. Musgrave.

September 21st.
2122. J. Dale.

September 22nd.
2132. C. Manby and W. Piper.

[*From Gazette, Sept.* 28, 1858.]

September 23rd.
2146. J. Norbury.

September 24th.
2129. J. Beattie.
2163. R. L. Johnson.
2175. J. Beattie.
2189. F. Uchatius.

Erratum.—The following patents, numbered respectively 1979, 1981, 1983, 1985, 1987, 1989, and 1991, were inserted in last week's *Journal* as taken from the Gazette of the 17th inst., instead of from that of the 10th inst.

Journal of the Society of Arts.

FRIDAY, OCTOBER 8, 1858.

ARSENIC IN PAPER HANGINGS.

The following extracts are taken by permission from the unpublished work "On Poisons," by Dr. Alfred S. Taylor, F.R.S., accompanied by remarks by that gentleman:—

"There is one form of chronic poisoning by arsenic on which it will be proper to make a few remarks, as the real cause may remain wholly unsuspected. Arsenic is largely employed in this country, under the form of emerald green (aceto-arsenite of copper), and of orpiment in the manufacture of decorative papers with which the walls of sitting and bedrooms are covered. Some persons have suffered from symptons of chronic poisoning by arsenic, in which no other cause was apparent than the continued respiration of the air of their rooms, charged probably at times with a fine arsenical dust. On examining the papers, they will be found in some instances loaded with arsenic, laid on in a rough and coarse manner, so as to be easily removable by friction. Arsenic is thus used in imparting a green tint to some of the most costly as well as the cheapest decorative papers. It is a practice fraught with danger in more respects than one, and under a proper system of medical police, it would not be permitted. In the kingdom of Prussia, the use of these papers is strictly prohibited. If there has not hitherto been much complaint on the subject, it may be attributed to the fact that the cause has not been suspected. Many obscure cases of illness, referred at the time to constitutional and other causes, may probably have been due to the effects of arsenical dust thus inhaled day and night by those who inhabited the rooms. Dr. Hinds, who suffered from the effects himself, has described two cases in which the prominent symptoms were prostration of strength, headache, thirst, loss of appetite—an inflammatory state of the conjunctivæ with heat and dryness of the fauces. (*Medical Times and Gazette*, May 23, 1857, p. 521.) A portion of the paper of the room in which these persons lived was sent to me, and on examination I found in the green pigment spread over it, a large quantity of arsenic. These facts should at least be borne in mind in cases in which it is suspected that poison is being secretly administered to another.

"Dr. Traill met with a case in which a child aged three years suffered severely from symptoms of arsenical poisoning, owing to its having sucked some slips of paper coloured with this green pigment; some of the paper, still retaining a green colour, was passed in the motions. The child recovered (*Edinburgh Monthly Journal*, July, 1851, page 1.)

"Among other uses of this noxious compound, we find it employed for imparting a bright green colour to the shelves of bakers' and green-grocers' shops. An incident which occurred to myself will show that food may thus acquire an arsenical impregnation. Several loaves of bread were supplied to me, having upon the undercrust a quantity of green-coloured pigment, which on analysis turned out to be arsenite of copper, containing about fifty per cent. of arsenic! On inquiry, I found that the baker had recently painted the shelves of his shop with this pigment, and the hot loaves placed upon them had taken off a portion of the arsenical paint. It is easy to conceive that an accident of this kind, if undetected, might lead to serious results, and perhaps to very erroneous suspicions. (*Medical Times and Gazette*, April, 1854, p. 326.)

"Another alleged form of poisoning by this substance which has attracted some attention, is in the state of vapour or fine dust applied to the membrane of the lungs, or in the state of powder as applied to the skin. In the former edition of this work the following case was related. A young man, after having been engaged for nine days in printing with an arsenical green pigment, was seized with irritation and watery discharge from the nose, swelling of the lips and nostrils, and headache. The next day he experienced severe colic, and great muscular weakness; but these symptoms disappeared in about eight days. It is probable that, in this case, the arsenite of copper had been taken into the body in the state of fine powder. (See Arsenical vapours, ante, p. 426.) I have since been informed, that the persons who manufacture and hang the coloured paper on walls, suffer from boils, inflammation of the eyes, and other symptoms of irritation. In one case now under treatment, pustular tumours have shown themselves on the wrists and ankles, and there is excessive sensitiveness and irritability of the skin. If removed the patients soon recover. In a former page I have alluded to the mysterious deaths of a whole family (see cases of the Arzone family, ante, p. 120). The father was a pigment-manufacturer, and there is great reason to believe that he and his family fell victims to the respiration of arsenical dust or vapours. According to M. Bouchardat (Annuaire de Thérapeutique, 1846, p. 209), the workmen who handle the emerald green in making the papers, are subject to serious disorders of health. They sometimes suffer from eruptions of the skin—one of the local effects of poisoning by arsenic (see *Assoc. Med. Journal*, 1856, Sept. 6, p. 371, 757; Sept. 20, p. 810, and ante, p. 371), with œdema (watery swelling) of the face, and boils frequently forming in the scrotum. There is irritation with discharge of fluid from the mucous membrane of the nose, and abundant salivation. In the more advanced stage, there are colicky pains, headache, and prostration of strength. (See Ann. d'Hyg. 1847, ii. p. 56; and *Journal de Chimie*, Juillet, 1858, pp. 394, 397.)

"More than ten years since, Dr. Martin announced that the use of this arsenical green in oil-paint had an injurious effect upon those who inhabited apartments recently painted with this substance. Four pounds of Scheele's green had been used in painting the walls of a low damp room. In a few days a putrescent and highly disagreeable odour was perceptible. When the windows were closed, those who remained in the room experienced headache, pain in the chest, and other disagreeable symptoms. The colour was scraped from the walls, and the room was then inhabited without any of these unpleasant symptoms being observed. Dr. Martin attributed the effects to the production of arsenuretted hydrogen. The poisonous salt may, however, have been itself carried off in vapour, like white lead, under similar circumstances, by the oil of turpentine. In a note attached to this case, it is stated that since the mixed acetate and arsenite have been substituted for carbonate of copper in painting the walls of rooms, many persons who have slept in rooms painted green, have complained in the morning of headache, nausea, dryness of the mouth and throat, and cough. The symptoms went off during the day. In one instance the foul odour was referred to mice, and the wainscot was about to be removed, when a suspicion arising that it was owing to the green colour used as a pigment, this was removed, and the smell disappeared. (*Gaz. Méd.* 13 Fev., 1847, 130.)

"I have elsewhere referred to the probable effects of wall-papers loosely covered with the aceto-arsenite of copper (ante p. 364). This pigment contains fifty-nine per cent. of arsenic, and from some of these papers the noxious material may easily be scraped or removed by friction. A square foot of the paper may yield from twenty-eight to seventy grains of the arsenical pigment, and in rooms exposing five or six-hundred square feet, a large quantity of arsenic is thus distributed over an extensive surface. Dr. Hinds, of Birmingham, noticed, that in occupying a room which was covered with a wall-paper of this kind, he suffered from severe depression,

nausea, pain in the abdomen, and great prostration of strength. These symptoms appeared every evening that he sat in this room: this led him to suspect that they were connected with this room, and on examining the paper he found in it a quantity of arsenic. (*Lancet*, 1857, vol. i., p. 193). Two other cases occurred in his practice, where similar symptoms were produced in a man and his wife, under similar circumstances. To these I have elsewhere referred (ante, p. 365). Dr. Halley, of Harley-street, suffered from constant headache, dryness of the throat and tongue, with internal irritation. In about three weeks, he became completely prostrated, and was threatened with paralysis of his left side. He called on me and described his symptoms, bringing, at the same time, a portion of the wall-paper of the room in which he was in the habit of sitting; and this I found to be loaded with arsenic. He removed the paper, and since then has recovered his health. Several cases have since come before me, in which, whether real or imaginary, symptoms of a *similar* kind have been referred by persons to the habitation of rooms papered with the arsenical green. At the same time, there have been many cases in which the occupation of rooms thus papered has been attended with no injurious effects. This fact, as well as a few imperfect experiments, have led some persons to affirm that the arsenical papers have not produced the effects ascribed to them. (See *Pharmaceutical Journal*, April, 1858, p. 520, and May, 1858, p. 554). The connexion of cause and effect, however, appears to me to be too plainly made out in the cases of Dr. Hinds and Dr. Halley, to be set aside as a mere coincidence. The symptoms in both cases were similar, and such as arsenic is well known to produce; there was no other source of arsenic, and no other cause to explain them; and they entirely ceased on the removal of the arsenical paper. It may not be easy to detect arsenic in the air of a room thus papered, but then it is equally difficult to detect lead in the air of freshly painted rooms, in which persons have been paralysed by passing a night. In the year 1837, and subsequently, arsenic was largely used in the manufacture of a spurious kind of wax-candle. The workmen suffered from boils and other disorders, and some who occupied rooms in which such candles were burnt, complained of symptoms like those of arsenical poisoning. As in reference to the arsenical papers, it was alleged,—because arsenic could not be detected in the air of a room, and all persons did not suffer from the use of the candles, that the illness was owing to some other cause. Although there are difficulties in explaining how it happens that more accidents do not occur, it appears to me there is already sufficient evidence to justify an enforcement of the Prussian regulation prohibiting the use of arsenic for such a manufacture, or in allowing the paper to be sold only on the condition that the words "arsenic, posion," are stamped upon it. (See *Pharm. Journal*, May, 1858, p. 553.)

"Dr. Böcker of Bonn, one of the most recent writers on Toxicology, refers to the effects of chronic poisoning produced on persons inhabiting rooms of which the walls are covered with arsenical paper hangings, and states, that on several occasions he has been called upon to treat such cases. A removal of the cause has generally proved sufficient. Dr. Böcker considers that a damp state of the wall renders them injurious. (Die Vergiftungen, 1857, p. 132.)"

Note.—I append an abstract of a notice issued by the Prussian government in reference to arsenical paper-hangings on the 3rd September, 1857. (Cuspers Vierteljabrschrift für Gerichtliche Medicin, Januar 1858, p. 184, Art, xxiii.)

"The Board of Police cannot too strongly impress on the public, the danger to health arising from the use of arsenical colours, especially in the habitation of rooms the walls of which are painted with such colours, or are covered with arsenical paper-hangings. The breathing of the vapours (air) in such rooms, has produced all the effects of slow poisoning by arsenic, namely, disordered digestion, difficulty of breathing, cough, colicky pains, weakness of the muscles, trembling and loss of power in the limbs, falling off of the hair, abscesses in the skin, emaciation, a wasting fever, and death. In removing arsenical papers from walls, they should be first well washed with salt-water, as the respiration of the arsenical dust may cause serious symptoms or death. The Board of Police earnestly entreat all medical men in their respective districts to advise the removal of arsenical colours from the dwellings in which they may be used.

"Konigl Polizei, Præsidium.

"Freiherr V. Zedlitz, Neukirch.

"Berlin, 3rd Sept. 1857."

Remarks.—It is not my intention to take part in the controversy which has arisen on this subject. It appears to me that it is leading the minds of the public from the true subject at issue. Mr. Phillips may be right in his conclusion that he could detect no arsenious acid in the air of a room covered with these poisonous paper-hangings; and "Crystallographer" may be right in assuming that the octahedral crystals seen by Dr. Halley may not have been arsenic but "miscroscopic diamonds" derived by some mysterious process from the carbon of the paper, or of the atmosphere. The question is not one of chemistry or crystallography, but really one of pathology. Certain symptoms, unquestionably those of arsenical poisoning, have arisen in certain persons who inhabited rooms of which the walls were covered with these papers. They have existed with the papers; they have disappeared on their removal. These facts are perfectly in accordance with those collected by the Prussian Government, and which have induced that Government authoritatively to prohibit the use of these paper-hangings.

Mr. Phillips brings forward his own case and that of his family, as a proof that the use of such papers is not noxious or injurious to the health. It would be easy to produce cases from the arsenic works of Cornwall, to show, by the exemption of some workmen, that the vapours of arsenic were *not* poisonous; and, from white-lead works, cases which show that many workmen do not suffer from lead poisoning; but it is well known that we are not all constructed alike in reference to the effects of poisons, and it is just possible that there may be a susceptibility to the action of arsenic in a few, while the majority may escape.

I must, however, express my surprise at Mr. Phillips's conclusion, which appears to me substantially to admit the great danger to which the use of these papers in our dwellings must expose us; whilst at the same time, his paper is leading the public to believe, because he found no "octahedral crystals," that there is no danger at all.* He says:—

"In conclusion, I beg to express my opinion that no danger need be apprehended from a paper such as the one annexed, in which but a small proportion of the surface is unglazed, provided ordinary care be used when removing the dust from the walls, but that even if such care were not exercised, it is doubtful (!) whether any pernicious effects would be felt by those inhabiting the room."†

The question immediately suggests itself—What will happen in the dwellings of those who cover their walls with cheap arsenic papers entirely unglazed? One of these I have now before me, and the arsenical pigment is rubbed off the surface with the slightest friction. Again, it would appear from his statement that even the glazed arsenical papers must be dusted with care. The breathing of the green dust of arsenite of copper may be just as fatal to life as the breathing of microscopic crystals of white arsenic; and, supposing that by careless dusting, &c., the poisonous material is diffused in a room, and is breathed by persons inhabiting it, it is by no means doubtful but certain what the effects would be.

* Leading article in *Daily News*, Sept. 1st, 1858.

† *Journal of Society of Arts*, August 27th, 1858, p. 607.

I am one of those who think that the fine and impalpable dust which is diffused through a room by currents of air, mechanical agitation, &c., is derived from the material on the walls as well as from the floor and ceiling. The walls generally present twice the extent of surface. If the powder on the walls is of an arsenical nature, it is not easy to perceive how, apart from the mechanical dusting of domestics (indispensable in most houses), we can prevent the occasional diffusion of a poisonous dust in an impalpable state. We are only made conscious of the existence of this diffused dust by the striking of a sunbeam across an inhabited room. They who prefer the "cheerful" green of an unglazed arsenical paper must, therefore, according to Mr. Phillips, be prepared to incur some risk—care must be taken that the walls are not too frequently or roughly dusted!

I have found, with respect to some of these papers, that they contain arsenic in a form soluble in water, and that in mixed patterns, parts of the papers surrounding the arsenical green colour are impregnated with arsenic. By scraping the arsenical pigment from the surface, or by soaking slips of the paper in water, the means of poisoning are always at hand. During the last summer I caused some of the arsenical paper to be moistened with water containing a small quantity of sugar. Flies which settled upon it were rapidly killed. As an objection to legislation for restricting the sale of arsenic, it was stated by a well-known pharmaceutist that arsenic might be easily procured for criminal purposes by scraping the walls of almost every dwelling house! This is an additional point for consideration in reference to the domestic use of this dangerous pigment. We require strong restrictions on the procuring of arsenic from a druggist's shop, and at the same time place the poison within reach of any evil-disposed person under such circumstances as to ensure secrecy of possession and use. A square foot of this paper contains enough arsenic to poison five or six persons.

In your *Journal*, Vol. v., p. 652, and Vol. vi, p. 606, you have made a reference to my evidence on this subject before a Committee of the House of Lords. I may mention to you that the inquiry arose under these circumstances. Their Lordships desired to know what became of the large quantity of arsenic manufactured in and imported into this country. I informed them that a very large proportion was spread in the form of pigments over the walls of our dwelling houses. I have since learnt that one London manufacturer alone was in the habit of using about *two tons of arsenic per week* in the production of this green pigment for paper-hangings! Its cheapness and durability as a colour recommend it strongly to public notice. Since the evidence which I gave before the Committee of the House of Lords, fifteen months ago, I have had still stronger reasons for holding the opinion then given respecting the danger attending the use of these papers. Mr. Phillips suggests glazing and no dusting. I would suggest that some other green colour should be selected, even at a little more cost. If the manufacture of arsenical papers is to be continued, the Prussian poison-symbol of a skull and cross-bones, with the motto *memento mori*, should be printed as a pattern upon it—or, at least, it should be intimated to all who purchase the paper-hangings that they contain arsenic.

ALFRED S. TAYLOR, M.D., F.R.S.

15, St. James's-terrace, Regent's-park,
September 27, 1858.

The following paper, by Dr. William Hinds, bearing immediately upon the same subject, is extracted from the *Pharmaceutical Journal* for the 1st inst.:—

Certain carefully-prepared papers, which recently appeared on the above subject in the pages of the *Pharmaceutical Journal*, not having been, as far as I am aware, fully replied to, I beg to offer to the readers of the above interesting journal a few observations on this subject. Great confusion of ideas seems to prevail extensively as to the facts brought before the public, while even the deleterious influence is itself denied in some quarters. It is by no means uncommon to see theoretical denials and disputes by some persons, in reference to facts and truths, which are nevertheless characterised by such stern features as to be realised *as* facts and truths by others. The views advanced by myself and others as to the injurious effects of arsenical papers in rooms, I believe to be unquestionable. Arsenite of copper, as a poisonous pigment, I find frequently recognised by writers on medical jurisprudence; but so far as I have been able to learn, to Dr. Alfred Taylor belongs the merit of more especially commenting upon the dangers to be apprehended from its employment. In his invaluable work, Dr. Taylor gives a case, in which "a young man, after having been engaged for nine days in printing with this arsenical green, was seized with caryza, swelling of the lips and nostrils, and headache. The next day he experienced severe colic and great muscular weakness." Dr. Taylor adds the valuable remark, that "in this case the arsenite of copper had been taken into the body in the state of fine powder."

This shows that Dr. Taylor's attention had been specially drawn to the subject. At the same time I may remark, that to the best of my knowledge, no case of actual poisoning had ever been made public, as having occurred from simply inhabiting a room hung with the arsenical paper, until my own case was published in the *Medical Times and Gazette* in February, 1857. The accident occurred to me as far back as 1849; but the case being, as I then thought, so unique and unparalleled, I hesitated to publish it until I had had means of collecting other cases, or until a favourable opportunity.

The way in which I was led, step by step, to certain conclusions as to the injurious effects, and also a description of these effects, are given exactly as they occurred in the paper mentioned, and to which I beg to refer those who may feel an interest in this subject.

In the next cases which came under my notice, the moral force of the evidence was so strong, as to satisfy the most sceptical. The injury occurred to a Mr. Simpson, of this city, and to his wife. Mr. S. had enjoyed the best health until he had a green flock paper put on the walls of two sitting-rooms. In a very few days he experienced all the symptoms of slow arsenical poisoning, but without either believing in, or even suspecting the cause. He became seriously ill, as also did his wife; and a fine parrot, which was hung in one of the rooms, all at once drooped and refused food. At this stage a gentleman, who had known of my own case, suggested a solution of the mystery as to the cause of the illness, but Mr. S. repudiated the supposition. He then left town for his health, returning in a fortnight quite strong and vigorous, and confident he should continue so. In several days he became again seriously ill, and after long residence, he became deeply convinced, by the very force of circumstances and suffering, that the cause lay in the wall paper. He underwent the expense of an entire removal of the paper, and soon after all were well. The gentleman here mentioned, would, I am sure, be glad to give his experience to any person who might be sceptical as to the facts.

Mr. S.'s case is fully detailed, without names, in the scientific journal before mentioned, for May, 1857.

In the case published by Dr. Halley in the *Times* newspaper, the facts and results are as striking and forcible as in the other published cases.

I have to say one word as to the mode of escape from these arsenical papers of the poisonous colouring matter, and I must observe that a vast deal of entirely irrelevant speculation and equally futile experiments have been expended, with a view to disprove facts, about which it is astonishing that any reasoning person can have a just doubt. A sample of this irrelevancy I will presently mention.

I find papers in this journal for May and June, evi-

dently from able contributors, denying our conclusions, which the space I could request would not enable me extensively to notice. For this, however, there is the less necessity, inasmuch as these writers give but negative results for the most part. I believe I am justified in saying that our positive facts and forcible moral evidence are not shaken by mere negative results, and miniature and usually irrelevant experiments. Neither is the question a mere chemical one, to be easily decided in miniature. The existence of the poisonous ingredient upon the paper is admitted, though one gentleman seeks to spoil this admission, by asserting (truly enough) that the flock portion is a mere dyed stuff, and contains nothing injurious. The injurious effects, moreover, of arsenite of copper, when inhaled, are equally admitted. Now, that mere water-colour pigment, without an overcoat of varnish, will give off, under certain hygrometric conditions, particles of its dust to the atmosphere, is perhaps so self-evident as not to require any laboured proof. The fact is indeed unquestionable. Take a feather or a soft white napkin, and run either never so lightly over a green paper of the ordinary kind, after it shall have been placed upon a wall by means of paste, and myriads of particles of the colour from the surface will adhere. Much, of course, is sent floating in the atmosphere of any room by the least possible disturbance of its contained air, as by draughts or the opening of doors. These particles will be then breathed into the lungs, and produce all the symptoms which have been described. A great deal has been said about volatilisation of arsenic and arsenical vapour, but it is not all to the purpose. Dr. Taylor's idea, as given in this journal for May last, and the same as it presented itself to me in the first case published, is, I believe, the only rational one—namely, that the finer and lighter particles of the colour escape as such. Now, what is the *dose* of this fine powder of Scheele's green necessary to produce bad symptoms? That is a question to which I cannot give an answer. Probably it is extremely small in quantity. Dr. Taylor, whose labours place him at the head of his department, in this country at least, has not attempted, so far as I know, to give a reply to this question; and the means by which the deleterious particles become active in the system, present several difficulties not easily to be solved.

There is one experiment I would beg to urge strongly upon the gentlemen who are sceptical as to our facts. It is that they should place themselves in the same conditions as those under which our facts were gathered. I shall be happy to furnish any gentleman who may wish to make the experiment, with samples of arsenical paper from which to select. Let a room be papered with one of these, and let the experimenter undergo the same experience as we who have suffered, and I shall have little doubt that he will come out of the trial fully convinced. It would be still better to make a series of trials, in order to avoid any incidental negation.

I may here mention the fact of the universal testimony of workmen who have been in the habit of hanging green papers, to the often severe symptoms which they experience while at work. One most powerful man, a paper-hanger, told me he has repeatedly got so ill with caryza, dryness of throat, and prostration, while hanging green paper, that he has been compelled to leave the room, and become unable to finish his work. This man could tell me himself that green paper was very injurious, though he was surprised to be told that the colour was arsenical. It is a fact worthy to be borne in mind, that in all these cases the *symptoms* were of the kind indicative of slow poisoning—namely, gastro-enteritic irritation, with intermittent colicy pains, nausea, prostration, loss of muscular power, caryza, heat, and dryness of throat; and, moreover, that in every case the cause was at first entirely unsuspected by those who suffered. In my own case I had not previously given the least notice to the colour of the paper, and did not trouble myself with any examination of it. It was only after suffering illness that my attention was gradually attracted to every altered condition of the room in which I sat to read. I had previously used the room for years with no inconvenience. The symptoms came on in three or four days after the papering. They ceased on my ceasing to occupy the room. They recurred every time I had for some hours again used it, and they never after appeared after the room was stripped of the injurious paper. The very same conditions, or very similar, were experienced by Dr. Halley, whose communication on the subject appeared in the *Times* of the 11th of January of the present year; and the same also in Mr. Simpson's case, to which I have before alluded.

I will now give a specimen of the "experiments" by which the facts we bring forward have been met. Several experiments have been detailed in this journal by Mr. F. A. Abel. I desire to be entirely just to Mr. Abel's efforts, but I cannot think his scientific knowledge was present to him at the time of those experiments. I will explain my meaning. On coming to the seventh experiment, Mr. A. makes the following most remarkable statement. He says: "It should be mentioned that in all these experiments, the *tube* was plugged with cotton wool." Now we refer to the other conditions of these experiments, and we find that the *temperature* is raised to only 90° on the one hand, and on the other, the tube was plugged with cotton wool, to allow no particles to escape mechanically! Mr. Abel will forgive me for reminding him of a fact he already knows—namely, that arsenic can only be volatilised by heat at a temperature of 380°; and yet he sticks to 90°, and plugs the escape-tube with cotton-wool, to prevent the mere mechanical passing of arsenic. I am sure Mr. A. will see the entire inconsistency and inapplicability of his whole experiments, on a reconsideration of the subject.

In Mr. Dugald Campbell's experiments, given with candour and clearness, the conditions were essentially different from those in which arsenic is given off in a room; for while the 140°, the highest point to which Mr. C. raised the temperature, were less by no smaller a quantity than 240° than the temperature required for the volatilisation of arsenic; a square foot only of paper, and *confined in a bottle*, is a very different thing from a square foot, indeed I might add 500 square feet, or 1000, pasted upon a wall, and subject to certain important hygrometric transitions, which favour the loosing of the colour, and its escape into the atmosphere of the room.

Some observations have also been made in the journal by Mr. B. H. Paul, and are given with great candour. Those remarks contain no experiments on the subject in question, and, as they are directed more especially against the gratuitously-conceived theory of vaporisation of pure arsenic by heat, inapplicable in the present case, require little remark. In conclusion, I may express my regret to perceive how completely an ascertained fact, as communicated by Dr. Taylor, in reference to the actual observance of particles of Scheele's green upon a slip of glass, can be ignored by a mere surmise.

BRITISH ASSOCIATION, LEEDS, 1858.

On the Progress of Mechanical Science.

The following is the Inaugural Address "On the Progress of Mechanical Science," delivered before the Mechanical Section of the British Association, by William Fairbairn, F.R.S., President of the Section:—

In opening the business of this section of the British Association, I have to congratulate you upon the encouraging prospects which our meeting in this great mart of industry is calculated to afford. This large and important district is only just recovering from a state of intense excitement and a burst of loyalty that have reverberated from one extremity of the Riding to the other. In these rejoicings I have naturally taken a deep

interest, and now that the royal visit is over, a meeting for the extension of science and useful art is probably the most appropriate conclusion of the festivities which have occupied the attention of this town for the last two weeks.

On a former occasion, when I had the honour of occupying the chair of this section, I endeavoured to combine in a condensed form such improvements in mechanical science as had been effected during the successive intervals between the annual meetings of this Association, and conceiving that a short account of what has taken place during the last few years may not be unacceptable, I have on this, as on previous occasions, ventured to direct your attention to a succinct retrospect of what I consider new and valuable in mechanical art.

In mechanical science and general engineering this country continues to maintain its high position in new developments and continued progress; and the almost innumerable patents weekly taken out under the new law, are remarkable indications of the activity and inventive power of the country. It is not yet thirty years since the introduction of malleable iron as a material for shipbuilding, and a much shorter time has elapsed since it was first applied to the construction of bridges. We have all of us heard of the tubular system so successfully applied to the bridges across the Conway and Menai Straits, and now it is extensively employed in every quarter of the globe. There is no span within the limit of one thousand feet, but which might be compassed by the hollow-girder bridge with security and effect. These discoveries are of immense importance to mankind, and where they are carried out with skill and a strict adherence to sound principles of economy and science, they give to the engineer of the present day a power which in former times it was impossible to realise.

Steam Navigation.—In this department of practical science, although much has been done, yet much remains to be accomplished in giving to the iron ship uniformity of strength and security of construction. In vessels of such complex form, bounded by such a variety of curved surfaces, we are yet much at sea as to the precise points of application of the material, in order to attain the maximum of strength combined with lightness and economy. These are data yet to be ascertained, and it will require long and laborious experimental research before the facts are clearly known and established. Much has, however, been accomplished in the absence of these data, and I may safely refer to that noble structure, the *Leviathan*, which, with all her misfortunes, is, nevertheless, a most magnificent specimen of naval architecture. The cellular system, so judiciously introduced by Mr. Brunel, is her great source of strength; and I am persuaded that she will stand the test (which I have recommended in other cases) of being suspended upon the two extreme points of stem and stern, with all her machinery on board. Or, these conditions being reversed, I believe she may be poised upon a point at her middle, like a scale-beam, without fracture or injury to the material of which she is composed. Her cellular construction and double sheathing round the hull, and the same formation on the upper deck, give to the vessel enormous powers of resistance, and her division and subdivision by bulkheads ensure a large margin of security, in whatever circumstances she may be placed. In fact, she may be considered as a large hollow girder, requiring a load of nearly 10,000 tons suspended from the centre to break her. I mention this to show that her want of success is not due to any want of success in the ship herself, but to the magnitude of the speculation as a commercial transaction, and her unmanageable character in regard to the shipment of cargo, and similar difficulties which she may be called upon to encounter. I hope, however, that the necessary funds will be forthcoming, and that we shall yet see her dashing aside the surge of the Atlantic at a speed of eighteen or twenty knots an hour.

Railways.—The magnitude of this great republic (as it is called) of speculation and industry is scarcely, if ever, appreciated by the public. We look at the locomotive of the present day, or glide by its means over the surface of the earth, without once thinking of the amount of skill and of capital expended in the production of such vast and important results. At the present moment we learn from returns recently published, that we have in this country alone 9,500 miles of railway executed and in actual operation. And, taking at a rough calculation one locomotive engine of 200 horses power to every three miles of railway, and assuming each to run 120 miles a day, we thence calculate the distance travelled over by railway trains to be equal to 380,000 miles per day, or the enormous distance of 138,000,000 of miles per annum, a space measuring the distance of the planets, and beyond the conception of those not conversant with figures. To transport engines and trams this distance, requires a force equivalent to that of upwards of two hundred thousand horses in constant operation throughout the year.

As regards the commercial value of railways, it will not be necessary to enlarge upon it in this place. Suffice it to observe that a clear revenue of £12,000,000 is left, after all expenses are paid, for distribution amongst shareholders and creditors. This amounts to 3¾ per cent. per annum, a small return upon £320,000,000, the original cost of 9,500 miles of railway, an average of £34,000 per mile.

In the locomotive engine there has been no improvement of importance during the last two years, excepting only its adaptation to burning coal instead of coke, without the production of smoke. To a certain extent this has been successfully accomplished, but the process is still far from perfect. Superior training is wanting for engineers and stokers before we can look forward with certainty to the time when the use of coal will become general, with increased economy and with the suppression of the nuisance of smoke.

In the formation of the permanent way considerable improvements have been effected, especially in the jointing of the rails by what is termed the fish-joint, which secures a more perfect union of the rails, produces a smoother surface, and diminishes the wear and tear of the rolling stock, when compared with the old system of jointing, so sensibly felt in carriages running over the line at great velocities.

Manufactures.—For the last twelve months, great depression has existed in this department of the national industry, and notwithstanding the attempts to cheapen the production of the staple articles of manufacture, by the introduction of improved machinery, there still exists a considerable depression in many of the great marts of industry. This is probably to be attributed to the disturbed state of India and China, but looking at the native activity of the manufacturing population, and the amount of capital employed, there has been no serious diminution in the production of manufactured articles, nor any stagnation in the demand for labour. On the contrary, I believe, with the exception of the causes just alluded to, that the manufactures of this country were never in a more flourishing condition.

In the iron trade, with which this section is more immediately connected, there has been a similar but slight depression, the manufacture of pigs, plates, and bars being as great as in any former year; and taking into account the improved process by which malleable iron and steel is now produced, there is reason to hope for a greatly increased demand and an enlarged production. In fact, such have been the improvements since Mr. Bessemer first announced his new process of boiling the crude iron direct from the smelting furnace, and dispensing with the puddling process, that we appear to be now in a state of transition from the old system of smelting, refining and puddling, to a more direct, continuous, and improved process of manufacture.

Steel bars and plates are now made without the intervention of an intermediate and tedious process, and we

may reasonably look forward to the introduction of an entirely new article of manufacture of greatly increased powers of resistance to strain. Although, hitherto, Mr. Bessemer has not succeeded in producing malleable iron by his new process, he has made beautiful refined iron, and has stimulated others to attempts at improvement in the same direction. His discoveries, first given to the world through this section of the British Association, have already proved of great value to the community, and we look forward with confidence to the introduction of still greater improvements—improvements by which steel plates and bars will be produced at almost the same price as we can now obtain the best manufactured iron.

The Machinery of Agriculture.—This is a branch of mechanical art which requires the careful consideration of the mechanician and the engineer. The time appears to have arrived when the introduction of machinery, combined with the wide diffusion of education amongst our agricultural population is absolutely necessary, and in my opinion, increased intelligence, together with new machinery, will double the production of the soil and improve the climate in which we live. Much as has already been done, very much has yet to be accomplished; we must persevere in the new processes of deep draining and subsoil ploughing, and in the substitution of steam power in place of horse and manual labour, before we can realise such large and important advantages as are now before us. Great changes and improvements have been effected in my own time, by the introduction of new implements to relieve the labours of the farm. Everything cannot, however, be done by the mechanician and engineer; much has to be done by the farmer in the preparation of the land to render it suitable for machine culture; and a willing heart as well as a steady hand is required of the agriculturist before he can work in concert with the engineer. The reaping machine has now attained such a degree of perfection as to bring it into general use on lands prepared for its reception, and the steam plough is making rapid strides towards perfection, and is likely to take the place of horses, and effect a change as beneficial to the farmer as it will be advantageous to the public at large.

Electric Telegraphs.—The consummation of telegraphic communication between the old and new worlds is the crowning triumph of the age, and I hail, in common with every lover of science, the immense benefits which the successful laying of the Atlantic cable is calculated to secure for mankind. It is another step forwards in the great march of civilisation, and the time is not far distant when we shall see individuals as well as nations united in social intercourse through the medium of the slender wire and the electric current. These are blessings which the most sanguine philosophers of the past never dreamt of. They are the realisation of the age in which we live, and I have to congratulate the section on what has already been done, and upon the benefits yet in store for us in the wide, and, to some extent, unexplored field of this wonderful discovery.

Telegraphic Cables.

The following is an abstract of a paper on the construction of Telegraphic Cables, read by Mr. Macintosh, before the same Section:—

In coating conducting wires with gutta percha or other insulating material, by means of rollers, each roller is grooved in its periphery, the grooves meeting to form an eye the size of the covering desired. Against the rollers are placed hoppers, in which the insulating material is placed in a warm plastic state. The gutta percha enters and fills up the grooves of the rollers, and where the rollers come together the insulating material in the grooves is brought together, firmly enclosing the conductor. The great strength and protection of these cables are obtained by embedding fibres of flax, hemp, or cotton, in an outer layer of insulating material. This is done with great pressure, which prevents the possibility of the insulating material ever separating. The cables so made are all cold vulcanised, by passing them through chloride of sulphur and a solvent, or through sulphuric acid and water, as they are made; this process thoroughly closing up the pores, and rendering the cables much less liable to be injured by heat or abrasion, and effectually preventing the decomposition of the gutta percha or Indian rubber.

In submerging these cables, they are passed through a canvass tube full of hard wood balls, and attached to the stern of the paying-out vessel by strong vulcanised Indian rubber springs, which prevents any injury to the cable in depositing it in the sea.

As these cables are made by machinery, they can be made in hundred-mile lengths or more without joints.

Leeds Exhibition of Local Industry.

The following is a notice of some of the articles shown in the mechanical division of the Leeds Exhibition of Local Industry, read before the same section by Mr. Joshua Buckton:—

On entering the shed specially set apart for such things, we notice a fine collection of malleable iron, boiler plates, and angle iron, as used in shipbuilding, from the Monk Bridge Works; locomotive crank and other axles in the forged and finished state, from the Clarence, the Leeds, the Farnley, and the Kirkstall Forge Company's Works; many wheel tyres with their uses shown in various forms, and fractures showing the grain and quality of the metal.

In the stand of the Kirkstall Forge Company is seen a beautiful model of a weighing crane, designed for raising and weighing heavy goods at one operation, thereby saving time and an immense amount of labour; the weighing being accomplished by a peculiar and simple adaptation of the principle of the steel yard. The apparatus can be disengaged, and the centres relieved of their weight by a locking movement acted upon by a lever; the crane then becomes an ordinary lifting crane.

Naylor's double steam hammer, also manufactured by the Kirkstall Forge Company, which need not be further mentioned here, as the inventor will himself read a paper on the same before this meeting. It is, however, too important a feature in the Exhibition for me to pass without notice.

In the machinery room we find a fine collection of engineers' tools, the manufacture of which has now become a most important branch of our local industry, the town of Leeds now ranking among the first in the empire in this peculiar branch. Most of the machines in this class will be found substantially built, exceedingly well got up, and the quality of casting admirable. A lathe for turning irregularly formed pieces of wood, and an endless tape saw, by Greenwood and Battey; and the beautiful adaptation of Combe's expanding pulley in the drilling machine of Joshua Buckton and Co., are well worthy of notice; of Combe's expanding pulley no more need be said here, the inventor having himself read a paper on it, showing its applicability to various purposes.

The woollen cloth dressing machinery, by Kempe and Co., should not be left unnoticed, though, perhaps, it may possess more of a local than general interest. Taylor's Corn Mill, with the upper stone stationary, the lower one revolving, is remarkable for simplicity and compactness of arrangement. They can be taken up and put down with great facility by the commonest workman, with the aid of a wrought-iron portable crane. Their smoothness of motion, nicest accuracy of adjustment, and simple movements, render them easy to manage, and not liable to much wear and tear. An improved quality of work is obtained by the centrifugal force imparted to the article being ground by the revolving under-stone, in clearing them of the ground substance, also producing a thorough draft or ventilation, thereby grinding at a lower temperature. The stones are 2 feet 8 inches and 3 feet

diameter, weighing 3 to 5 cwt. each, versus 15 to 20 cwt., the weight of ordinary millstones. They are effectually driven by a 4½ inch belt, which entirely dispenses with all foundations, and materially reduces the cost of masonry; they stand complete in a self-contained frame, and may be placed on any floor.

The stationary pumping and other engines by Carret, Marshall and Co., should not be passed unnoticed, being well designed and the workmanship first-class.

Leaving the machinery room and ascending to the south gallery, we find in motion Combe's and Smallpage's new double-cam power-loom.

In this power-loom all the movements for plain weaving are obtained from one shaft, perfectly balanced in itself, and revolving at half the speed of the crank shaft of the old loom, the internal and external surface of a pair of double cams being made to act on rollers connected with the going part of the loom. According to the formation of the cams, all the movements of the hand weaver may be imitated with the utmost nicety; a blow may be given adapted to the tenderest linen or the heaviest sail cloth, and a frame made to suit the broadest or narrowest weaving. In the shuttle used in the loom, the weft is packed into the shuttle in the form of a hollow roll, and drawn from the internal surface, by which means, for tender yarns, a shuttle may be used half as thick as the common shuttle, and still carrying double the usual quantity of weft; or for carpet and canvass weaving, a shuttle of the ordinary dimensions may be made to carry four times the usual quantity of weft. By using a thin shuttle in conjunction with a dead pause at the back, the throw of the going part may be diminished one-half, and the number of times which the reed will chafe on the warp reduced in the same proportion by the introduction of the loom and shuttle.

The loom exhibited by John Holmes, also in operation, for working ladies' corsets without a seam (as sample shown), is well worthy of inspection. It differs from the ordinary way of weaving, by the yarn being on several pullies in small quantities, instead of all being on one beam as in the common loom. A brass belt is attached to it pierced with several holes at certain distances, and moves one-eighth of an inch for every four picks of the shuttle. Small pins, four in number, fall in the brass belt at certain intervals, and make the different changes necessary for the production of the several kinds and shapes of cloth for a corset; and the take up or nippers in front of the loom are in the place of a cloth beam, and draw the cloth straight permanently, whether the machine is working cloth at either side or straight across. An inspection of this machine is necessary to comprehend its merits.

Milner's card setting machine is also to be seen at work. Haste's new apparatus for preventing the explosions of steam boilers is well worthy of inspection, being entirely self-acting, enclosed in a case under lock and key. The apparatus is shown complete and in section, exposing its internal arrangements.

A working model of Donnisthorpe's wool-combing machine, made one-quarter the size of the original, is well worthy of inspection. Joy and Holt's self-acting hydraulic engine, worked by the water from the Leeds Water Works' pipes, for the working of the bellows attached to the organ built by Mr. Holt, should certainly be seen. Similar hydraulic engines are used to blow the large organ in our Town Hall.

Open Competitive Examinations.

A paper on this subject was read by Edwin Chadwick, C.B., before the Section of Economic Science and Statistics.

Mr. Chadwick said that in compliance with the request of the committee, he would begin by stating the results of the practical application of the principle of competitive examinations since the last meeting of the Association held at Dublin. He would, however, in the first place, recapitulate the chief economical principles involved in this question. The first of these was the application to services of the principle which Mr. Babbage, in his treatise on the Economy of Manufactures, had exemplified as applicable to manufactures or commodities, and which he expressed as the "saving of the labour of verification;" of which Tower-proof marks for fire-arms, Hall-marks for plate, coinage for metals, were examples, serving for the verification of the attainment of given standards. The application of the principle to the public service would often save the expense of appointing two or three persons to perform work that might be better performed by one of assured qualification,—appointing for new work a number of persons, as on boards, on the chance that one might be found specially qualified, and take the lead in the performance of the required service. And the like economy was applicable to private service. Thus, from the collateral or direct application of the principle to the testing of efficient or inefficient schools, the economy to parents, in obviating the almost total loss of their investments in the education of their children—the economy of time, not to speak of greater considerations belonging to the moralist,—to the children themselves would be enormous; for, added to these economies, there was the economy of time to the pupil or the parent in having authentic and definite standards of the required qualifications, and the great economy of time in attaining them effected by the impetus of competition. For the attainment of these economies the mere pass examination, to a fixed minimum standard, was proved to be generally untrustworthy, and often fraudulent. The cram sufficed for the mere pass examination, but with a properly regulated verbal, as well as written, open and public competitive examination, cramming, in Mr. Chadwick's opinion, was impossible. He would now state in answer to the expectation of the section of its meed of statistics—that of the chief open competitive examinations publicly and properly notified as open to all comers, they had as yet no recent statistics. There were on the average about twenty writerships given to open competition, and as many medical appointments; then there were about thirty cadetships at Woolwich—in all, perhaps, about seventy or eighty situations annually—which were at present the subject of *bonâ fide* open competition. The opening of the cadetships of the Engineers and Artillery for the Indian army would give perhaps as many more as at Woolwich. The only competition of this character for the civil service during the last year had been one—only one—for a single clerkship, at the disposal of the Civil Service Commissioners themselves, and described at some length in their last report, with their statement of reasons, the result of prolonged observation, for the principle of their preference for full, open, and public competition, in accordance with the resolutions of parliament, to the nominated competitions which they had been required to conduct. These nominated, or, properly speaking, the close patronage-appointed competitions, appeared to be on the average of three candidates for one place. The vacancies were unnotified and unknown to the educational institutions or the general public, and the candidates were named by the departments. The results of competitions in which there were both patronage-appointed and open-competition candidates were very much in favour of the latter. Nevertheless, in the face of clear proofs of the benefit it was calculated to confer, it had been determined to suppress the principle of open competition for army commissions, by restricting it to nominated cadets. It was alleged in the House of Commons, by public officers, that there was no intention to do so, but this must be a mistake. Mr. Chadwick dwelt at considerable length upon the importance of the general principle of making all appointments according to merit, and quoted from various reports and other documents to show the evils that had in many cases arisen from following a different

course. With regard to the effect of competitive examination upon the candidates themselves, Professors Galbraith and Houghton, in their published report in respect to the last Woolwich examinations, had stated:—"As a proof of the benefits conferred by the competitive system, we may mention that subjects hitherto neglected, and some never heard of, in Irish schools are now particularly attended to and diligently taught. We may specify English and French literature and certain advanced branches of science, such as mechanics and hydrostatics. The effects of this system on the study in the university are most striking. We have been fellows of Trinity College since 1844, and have never witnessed anything like the exertions to acquire knowledge made within the last two years. The effect on the teachers is no less remarkable than on the learners. We all feel that our honour is at stake in sending forward candidates to these public contests, where the youth of the entire kingdom assemble for competition." This had been corroborated in other reports. The evils resulting from patronage in another branch of public service, diplomatic appointments, were then pointed out, and instances of the incompetence of several who had held high positions were given. This had been particularly the case with regard to consuls, in the appointment of whom there had been great abuses. The French, on the other hand, had adopted securities for the qualification of their consuls, tested by examinations on the principles proposed. A consul should carry with him, for the public service, a knowledge of the legal institutions of his country, and obtain an acquaintance with the legal and municipal institutions of the country where he resides. The French regulations required that the consul should have the diploma of an advocate, which was only obtainable upon real examinations; and, moreover, that he should have a special knowledge of French treaties, and professional ability in dealing with the questions which arose out of their nonobservance. Mr. Chadwick replied at some length to objections that had been urged against the system he was advocating, on the alleged ground that its introduction tended to lower the average of the physical qualities possessed by those who obtained appointments, and continued as follows:—"Since we last met the principle has made progress in unexpected directions where it will have important bearings in political relations of the empire; for an act has been passed by the legislature of Canada 'For improving the organisation and improving the efficiency of its civil service,' which act adopts our principle of special qualifications for the service tested by open competition, before a board of examiners, as proposed in England. The principle has also been introduced into Malta, under the auspices of the enlightened governor, Sir William Reid, who reports, 'I continue to be of opinion that the system of giving clerkships under 22 years of age, to those who pass the best examination, is working advantageously for Malta, and the competition created is evidently having the effect of improving the schools.' I am informed that, with others of our administrative reforms, the principle of open competition is under consideration for adoption in Australia. I beg leave to submit that the course taken by the legislature of Canada, as well as that indicated in Australia, is of the highest import for the advancement of economic science and public administration, for the preservation of representative institutions from degradation, as well as for the educational and political progress of the colonial population. The first effect of the principle of open competition is in getting rid of the obstructive operation of great, and in the colonies peculiarly odious, irrelevancies—as I term them. What it would be in this association, if we were, on questions of science, to enter into the professor's theological or political opinions, or those of his parents, if for example, before considering the views of a professor on electricity, which he has deeply and profoundly studied, we were to discuss his views on politics or theology, which he probably cannot have studied, but will probably have taken on credit—as it would be with the progress of sciences here, so it is, to the extent to which it prevails in public administration. In Ireland how odious is it to see in times when one party is predominant, the service of the engineers or the artillery deprived of the superior qualifications of a graduate of Trinity College, Dublin, because his father is a Protestant and an Orangeman; or, on the predominance of another party, to see shut out a young man of superior acquisitions in engineering science, because, like his parent, he is a Roman Catholic! As we make progress in art and science, greater and greater devotion is required to divisions and subdivisions of labour, and this attention to those subdivisions almost precludes attention to other wide general controversial questions of politics or theology, and almost necessitates their adoption on trust, and makes the perseverance in the adoption of those irrelevancies as tests, the more odiously unjust towards the young. The competitive principle, as testing the qualifications for the specialities of service, avoids all this. In Canada, it must avoid hateful feelings and jealousies of mere race. In Australia it will assure the young and best qualified candidate, that if, upon the prolonged probation—which is the adjunct of our principle—his own conduct displays his purification, he shall be as little prejudiced by his antecedents as if he were a descendant of one of our greatest historical scoundrels and traitors—amongst whose descendants, or such of them as remain to show—as many of them do show, in an exemplary manner, the purifying influence of the time and civilisation—our great historical depictor of their progenitors, Lord Macaulay, is sent to associate. The principle, in its operation in those colonies, is a bounty on moral purification. At the same time, in counteracting noxious anti-social irrelevancies to the proper object in hand—the principle tends, by freeing the exercise of special qualifications from their disturbance, to facilitate those applications of science to the improvement of administration, of which one condition of progress is permanence in their prosecution. The development of the principle of government by the great irrelevancies of general political party principles, as against special qualifications, may be seen on a gigantic scale in the United States. I have received, from very able officers, either of the State or general government, inquiries on questions of administrative improvements, which I have had specially to consider; such, for instance, as the application of sanitary science to the improvement of the population; improvements in the statistics of administration, for which most important fields were opened in America. But, on inquiry as to their progress, I have been informed that they had been ejected by a change of political parties, and that the attempt was extinguished. Under such conditions, the introduction of improvements of a scientific character in public administration appears to me to be generally hopeless. The effect of the frequent changes of the political chiefs of departments in England is bad enough; but in the United States the whole of the office holders—all of one class of permanent civil servants, are dismissed with each presidential change of party, and the entire service of the country is held up as the spoil of party conflicts; and during the short tenure of office those who gain that spoil are led to extend it beyond the direct emoluments of their office. According to authentic reports—according to the statements and lamentations of respectable Americans, the friends of progress, in no legislative or administrative bodies in the old country is there so much bribery and corruption; the character of the judiciaries as well as the legislation and public administration has been degraded, and on account of their failure a recourse to Lynch law, and vigilance committees and armed violence, has often become a matter of necessity and a reactionary corrective. Now, the course approved by the Canadian legislature, of holding out public offices as prizes for the advancement of education, and for acquirements in their schools of those qualifications which are equally available for the private and

open professions, and withdrawing the public emoluments as prizes for conflicts of party passion and violence on political platforms, is the best measure for preserving free representative institutions from degradation, and ensuring to that great colony a rate of advance in social as well as political progress which, under the existing conditions of the United States, must be hopeless, unless the contending parties can be brought to consider the principle, to concede to their educational institutions the rewards which they will not yield to each other. For these reasons, and for stimulating and testing the progress of their rising educational institutions, the principle may be solemnly commended to the earnest consideration of all our colonial legislatures as well as to our relations in the United States." After giving instances to show the illusory character of the nominated close competitons, of twos and threes for one office, he said he felt it his duty to represent that the principle was in hostile executive hands, and that it behoved all friends of education and science to exert themselves with the public, and press upon their representatives the necessity of its extension to all junior appointments in every branch of the service, to demand public notification of all vacancies, and an open and fair field, without political favour, for the proved capacities of the country.

HOROLOGICAL INSTITUTE.

A Horological Institute has been established in Clerkenwell, the object of which is to develope the science of Horology, to foster the arts and various branches of manufacture arising out of it, and to stimulate and encourage the production of the best workmanship by suitable rewards and marks of distinction; and to attain these results by the formation of a library, reading-room, and a collection of tools, models, and machinery; also by the delivery of lectures, and the reading of original papers on subjects connected with the art of Horology and the various branches of trade or manufacture connected therewith. A monthly journal is issued by the Society.

PRESERVATION OF ANIMAL AND VEGETABLE SUBSTANCES.

A patent has lately been taken out for effecting this object. The improvements consist in coating animal and vegetable substances with a compound formed of vegetable albumen and a suitable antiseptic material. The coating is effected by immersing the substances to be preserved in the prepared compound two or three times, each coating being dried or set in a current of air before the next is applied. The object of combining an antiseptic agent with the vegetable albumen is to prevent a partial decomposition of the substances occurring before the protective coating is properly hardened. The following means may be adopted for carrying the invention into effect:—Supposing a joint of meat to be the substance to be preserved, the meat (with as much of its blood extracted as possible) is first washed or immersed in water impregnated with acetate of alumina and allowed to drain, it is then suspended by a string, and allowed to descend into a bath composed by placing about one pound of gum adraganthe (or gum dragon) in from one and a-half to two gallons of heated water for about twenty-four hours, straining the solution, then mixing with it a warm solution of about six ounces of gelatine or paste, and finally adding about ten ounces of acetate of alumina, mixing and straining. The meat is kept in this bath for about two minutes, being drawn and moved about in it by the string, it is then taken out and suspended in a current of dry air for about twenty-four hours. The process of immersion, &c., is then repeated once or twice, as may be considered desirable.

ANALYSIS OF METROPOLITAN WATERS.

The Registrar General in his last report makes the following statement:—

The waters supplied to the metropolis have been examined during the month of August by Dr. Robert Dundas Thomson, F.R.S., of St Thomas's Hospital, who found their composition to be as exhibited in the subsequent table. It will be observed that the amount of impurity in each water is less than in any previous month of the year, in consequence of the great dryness of the period to which the analyses refer. A comparison of the present with former tables will show how far the condition of the waters is improving. For the sake of comparison, the composition of Glasgow waters is appended. The inhabitants of that city are not satisfied with the Clyde supply, though much cleaner than that of the Thames, and the water of a Highland lake, approaching distilled water in purity, will soon flow into the city by gravitation.

—	Total impurity per gallon.	Organic impurity per gallon.
	Grs., or °.	Grs., or °.
Distilled water	0·0	0·0
Clyde, present supply at Glasgow	9·57	1·08
Loch Katrine, new supply to Glasgow	2·15	0·80
THAMES COMPANIES:—		
Chelsea	15·88	·92
Southwark	16·00	1·96
Lambeth	17·40	1·08
Grand Junction	16·40	1·72
West Middlesex	15·36	1·28
OTHER COMPANIES:—		
East London	16·68	1·60
New River	15·52	1·32
Kent	22·60	1·88

This table exhibits the amount of foreign matter contained in each gallon of water expressed in degrees or grains. The samples were all taken from main pipes.

WHITE BRASS, OR UNOXIDIZABLE CAST IRON.

M. Porel, of Paris, has prepared an alloy which has the appearance and fracture of ordinary zinc, but it is as hard as copper or iron, and tougher than cast iron. It may be turned, filed, or drilled, as easily as those metals; does not adhere to metal moulds, and retains its metallic lustre perfectly in a moist atmosphere. This alloy is prepared by melting together zinc, copper, and cast iron. It contains 10 per cent. copper and 10 per cent. iron. This alloy may be used for various purposes in the construction of machinery; it may be made to appear like bronze, either by covering it with a deposit of metal, or by throwing up the copper superficially, and is, therefore, well adapted for casting vases, statues, and other objects of artistic character that are to be exposed to the atmosphere, especially as it is not a costly material.—*Mining Journal.*

Proceedings of Institutions.

GRAHAM'S TOWN (CAPE OF GOOD HOPE).—The third annual report of the Literary, Scientific, and Medical Society, states that the fortnightly meetings have been regularly held, except during the period of vacation from December, 1857, to April, 1858, and lectures have been delivered of a varied and instructive kind, on different literary and scientific subjects. In these lectures, Agriculture,—a subject of much interest to the colony, has been brought prominently forward. The current session

was begun with increased activity. The introductory lecture was kindly delivered by the Lord Bishop of Graham's Town, to a very large audience, and considerable interest has been taken by the members in all the subsequent lectures. In October and November last, a series of object lessons was given to a number of young persons, by Dr. Edmunds, Messrs. B. Glanville, and McDonald, the design being the illustration in a simple and popular style of the contents of the Museum. The attendance was very favourable, the teachers of several schools having availed themselves of the opportunity to bring their senior pupils to these lessons. Many valuable specimens have been added to the museum, but in consequence of maintaining it on the slender means which the society could afford, the liabilities of the society have considerably exceeded its limited income, and the committee applied a short time ago for pecuniary aid from the government; this application was favourably received by the Governor, who caused to be placed upon the estimates, for the support of the museum, the sum of £150 as an annual grant. The following is a list of lectures delivered:—Mr. McDonald, "On Meteorology;" Mr. Kennelly, "On Music;" Rev. J. Heavyside, "The Merovingian Era;" Mr. Glanville, "Hugh Millers' Work, the Testimony of the Rocks"; (two lectures), Mr. G. Wright, "Retrospect of History;" Mr. W. Young, "Poetry of Mrs. Hemans;" Mr. Kennelly, "Music" 2nd lecture; Mr. J. Standen, "Phrenology;" Mr. Franklin, "Reminiscences of Travel;" The Lord Bishop of Graham's Town, "Introductory Lecture to Session of 1858;" Mr. McDonald, "Moral Philosophy;" Mr. Glanville, "The causes of the present efficient state of Agriculture in Great Britain and other Countries;" Dr. Edmunds, "Our Food, Animal and Vegetable;" Rev. E. Cornford, "Domestic and Social Life of the Ancient Greeks;" Mr. Tudhope, "Agriculture." An Art exhibition has been lately held in the society's-rooms, embracing an extensive collection of pictures, engravings, and articles of virtu, which has attracted much attention in the colony.

Leeds (Christian Institute).—On Tuesday evening, 28th September, a soirée in connection with this Institute was held in the Stock Exchange Hall. The Right Hon. M. T. Baines, M.P., occupied the chair, and was surrounded by Sir John Herschel, Sir R. I. Murchison, Rev. Dr. Booth, Dr. Gladstone, Rev. J. Blomefield, Rev. H. R. Reynolds, Rev. G. W. Conder, Rev. W. Guest, Rev. S. Hulme, Rev. J. D. Brocklehurst, &c., &c. The Right Hon. M. T. Baines, on rising to address the meeting, said he assured them that he had the greatest pleasure in attending there that night for the purpose of testifying the very great respect—the heartfelt respect which he entertained for themselves and for the object which he understood they had in view in that institution—that object, unless he was mistaken, being to enable young men to combine the cultivation of all the graces of a truly Christian character, with the improvement of their intellectual powers, and the attainment of really valuable knowledge. In the course of his address, he observed that that institution, for the superiority of its class instruction and success of its pupils, was found to stand the third in the kingdom according to the Society of Arts' returns. They had eleven pupils who obtained certificates, two first-prize men, one second-prize man, and one of the former who had obtained in addition, at the Oxford Examination, the degree of A. A., and prize of £5 from the delegates of the Oxford Board. These facts, though they lay in a very narrow compass, bore, in his opinion, a most valuable testimony to the operations of the society, and entitled it to the cordial good wishes of all who could appreciate self-denial, industry, and Christian principle. The chairman concluded by introducing Sir John Herschel, who was received with great enthusiasm. He said that when he was invited to attend that meeting, he understood that he should be called upon to distribute the prizes for astronomy to those young men who had distinguished themselves by their attainments in that science in the Society of Arts' examinations. That arrangement, however, had been very properly altered, and the prizes being considered as distributed, he felt himself at liberty to choose the ground upon which he should address the meeting. As a member of the Society of Arts, his opinion had been requested as to the system of examination, and he gave it most cordially in favour of the proposed scheme; and he stood there, therefore, not merely as a casual visitor, but as one having some more special interest, at least in one part of their proceedings. As a member of the Society of Arts, he must, in the first instance, express his gratification at the well-working of the system in this particular instance; and in the next place, he thought he ought to congratulate the Leeds Young Men's Christian Institution upon the success achieved by several of its pupils in the examination. With these remarks he might proceed, but he should confine his observations to the general testimony which science bore in favour of religion, a testimony which, speaking in the name of science, he had never been backward to give, and which he should never shrink, either on that or any other occasion, from giving. Sir John Herschel then directed his observations especially to the encouragement of those young men who had distinguished themselves in the particular branch of science to which he was himself devoted, astronomy, and concluded by proposing the following resolution:—"That this meeting recognises with pleasure the efforts so successfully made in the Young Men's Christian Association to unite the cultivation of science and literature with the nourishment of true virtue and spiritual religion." Sir R. Murchison seconded the resolution, and, in the course of his remarks, said he was anxious to impress upon the members of that Institution the importance of cultivating, as much as was in their power, an acquaintance with geology. He was glad to learn that there was a geological institution at Leeds, and he should be most happy, as director-general of the Geological Survey of the British Isles, to assist that particular Institute by every means in his power. He promised to send to it all the volumes connected with the illustration of the geology of the British Isles which were within his control, and this, he hoped, would prove his good will and sincerity in the cause they were met together to celebrate. The Chairman then distributed the prizes and certificates awarded by the Society of Arts to members of the Institute. The Rev. Dr. Booth, in supporting the motion, observed that he could not recollect any period in the history of this country when so many inducements and so much encouragement were held out to the working and middle classes to promote their own self-improvement. In his opinion, the great work of self-improvement was not to be done for them, but by them. No one would deprecate more than he would the pursuit of mental improvement with the sole object of raising themselves in life, or obtaining any particular situation. They must study irrespective of these considerations, and with a determination above all to do their duty. The Rev. H. R. Reynolds moved the following resolution:—"That this meeting heartily welcomes the delegates now present from the Young Men's Christian Associations of Great Britain and Ireland, and extends its cordial Christian sympathy and best wishes to the Associations they represent." The Rev. J. Blomefield seconded the resolution, and the meeting was afterwards addressed by the Rev. T. H. Tarlton, Dr. Gladstone, the Rev. M. Brocklehurst, the Rev. S. Hulme, and Mr. W. E. Shipton. Mr. T. A. Pane moved, and Mr. Dawbarn, of Wisbeach, seconded, a vote of thanks to the chairman, which was duly acknowledged, and the meeting then separated.

Leeds (Mechanics' Institution).—A soirée took place in the Leeds Town Hall, on Wednesday evening, the 29th ult., under the auspices of the Mechanics' Institution and Literary Society, at which were distributed the

prizes and certificates of the Society of Arts awarded at the late examination to students from that Institution. Long before the hour fixed for the meeting the hall was crowded in every part. Lord Goderich occupied the chair, and amongst those present were the Earl of Carlisle, Sir R. I. Murchison, Sir P. Fairbairn, Sir C. Nicholson (Provost of the University of Sydney, Australia), Right Hon. M. T. Baines, M.P., Professor Owen, Mr. R. M. Milnes, M.P., Professor Phillips, Professor Hennessy, Dr. Norton Shaw, Rev. Dr. Booth, Rev. Dr. Hook, Mr. E. Chadwick, C.B., Admiral Fitzroy, F.R.S., Admiral Grace, Dr. Lee (President of the Meteorological Society), Mr. Ald. Oxley, Mr. Ald. Bateson, Mr. Ald. Blackburn, Mr. Ald. Botterill (President of the Institution), Mr. Ald. Kelsall, Rev. C. P. Chretien (Oxford), Rev. H. R. Reynolds, Rev. G. W. Conder, Rev. J. H. Ryland (Bradford), Mr. E. Baines, Mr. J. Hole, &c., &c. The CHAIRMAN said, he had little doubt that many of whose who attended the last annual meeting of the Leeds Mechanics' Institution would have thought that that meeting was likely to have been one of the most memorable that ever was held in connection with this body; for it was difficult to have supposed that anything could have equalled that assembly, presided over by Lord Brougham, a man eminently distinguished as a friend of science, a statesman, and a lawyer. He thought, however, that no meeting of this Mechanics' Institution, or, indeed, of any other, had ever been held under more favourable auspices than this; for that evening, the objects of the Leeds Mechanics' Institution were sanctioned by the presence of some of the most distinguished men, he would not say of England, but of the civilised world, who had consented to be present on this occasion, in order that they might show that they, at all events, were hearty approvers of the work in which Mechanics' Institutes were engaged. With regard to the present state of prosperity of the Institution, he found that the Leeds Mechanics' Institution was possessed, at the present moment, of 1,600 members, and that its yearly income amounted to the large sum of £3,000. Besides these, there were no less than 90 scholars in the boys' school, 60 pupils in the boys' evening class, 80 scholars in the ladies' educational institution, and 30 in the ladies' evening class; so that they would see that the benefits of the Institution extended to a very wi le circle indeed. In addition to the pupils of whom he had spoken, there were connected with the Institution no less than 2,200 persons, the pupils of the School of Art. There was no doubt that the Institution was doing its work efficiently, and the best practical proof that could be given of this was the distribution of certain prizes which had been won by the members of this Mechanics' Institution in close competition with the other institutions of the country. In spite of this, however, he found that in order to carry out their extensive operations, the managers had been obliged to incur debts. He had been requested, however, to take this opportunity of informing them that it was intended, next year, to hold a bazaar for the benefit of this Institution, and that that bazaar was to be held under the patronage of Her Majesty the Queen. His lordship then alluded to the Royal visit to Leeds, and expressed his opinion that no one who had been present on that occasion, and had seen the order, the good temper, and the loyalty which were displayed by the half-million of the working classes who then thronged the streets—no man who witnessed that most glorious and striking scene, could have doubted, if he had compared it with such visits in former times, that there had been the working of some potent influence and some elevating improvement upon the people of this county; and he could not doubt that among them one of the most powerful had been the spread of education. To that work Mechanics' Institutes had materially contributed, as well as those other gratifying circumstances which they had lately witnessed—that fortunate union among all classes, that happy intercourse and good feeling and mutual confidence between employers and employed which had been spread of late far and wide. — The Earl of CARLISLE proposed the following sentiment:—"Success to the Leeds Mechanics' Institution and Literary Society, and all similar societies, as they materially promote the development of the chief sources of intellectual cultivation." He would not himself speak on the subject of Mechanics' Institutions, but what he had to say would be entirely of a local and personal character. He had himself followed the fortunes of the good town of Leeds, as well as of the cluster of sister communities which formed the West Riding, and although they undoubtedly had been of a chequered character, as the gleams and shadows of peace and war, of panic and activity, had alternately flitted over them, yet the whole result conveyed to him was that of increasing enterprise, of triumphant industry, and of growing greatness. Above all, he had rejoiced to perceive the evidences of moral progress, as it had been testified by the encouragement given to education, by the multiplication of Mechanics' Institutes, literary societies, and schools of art, by the added facilities for public worship, and by the spirit of order and obedience to the law which had distinguished these swarming hives of industry. — Sir R. I. MURCHISON seconded the resolution, particularly alluding, in the course of his address to the meeting of the British Association at Leeds. The Rev. Dr. BOOTH spoke upon the sentiment—"That the present movements in education tend to encourage the working classes to promote their self-improvement." He remarked that when they had previously discussed the question, how Mechanics' Institutes were to encourage self-improvement, their arguments were little better than reasons in support of a speculative theory, which theory was now no longer such, but was based upon experimental facts. He should not enter into the discussion of the arguments by which this system was recommended, not only as supplying a number of young men, highly cultivated for the public service, but still more as affording the greatest possible stimulus to national education. He would, however, in his anxiety for the success of this measure, address to them one or two cautions. First, they might examine too much, because the processes of the mind in acquiring knowledge were directly opposed, he might say, to those for its manifestation; and, therefore, he should shrink from seeing the system of examination extended to very young boys. He would also press upon them another caution, strongly advising them that if they had laid a sound foundation of elementary knowledge, they should endeavour to build upon it some massive and simple structure, dedicated to one or two departments only of intellectual worship, instead of attempting to embrace too many subjects, which would only lead to their knowledge being superficial.—Mr. CHADWICK supported the resolution.—Lord GODERICH then proceeded to distribute the medals awarded by the Department of Science and Art. His Lordship next distributed the prizes and certificates awarded by the Society of Arts to successful candidates at this year's examination.—Professor OWEN then proposed the following sentiment: "The advancement of science—to the steady pursuit of which Britain owes much of her elevation among the nations of the world;" this was seconded by Sir Charles Nicholson, provost of the University of Sydney, and late Speaker in the Legislature of New South Wales. He said he had, for upwards of twenty years, been connected with an institution similar to the Leeds Mechanics' Institution in a very remote part of the world—he alluded to the Mechanics' Institution of Sydney—an Institution which, when he first joined it, did not number more than 20 or 30 members, but now comprised 1,200 or 1,300. For this reason, as well as for the deep interest which Australian colonists must feel in all that related to Leeds, he had been induced to take part in that meeting. —Mr. R. M. MILNES M.P., proposed the next sentiment,

which was as follows:—"The extension of Schools of Art, as they impart a taste for artistic beauty, and give familiarity with the principles on which it rests."—The Right Hon. M. T. BAINES, M.P., expressed his hearty concurrence in the sentiment.—Admiral FITZROY, head of the metropolitan department of the Board of Trade, submitted the next sentiment:—"That the union of different classes and parties in these institutions tends to the removal of prejudice, and the cultivation of friendly feelings."—Dr. NORTON SHAW also addressed the meeting on the sentiment, which was supported by Professor CHRETIEN, who briefly alluded to the Oxford Examinations.—Sir PETER FAIRBAIRN, the mayor, proposed a vote of thanks to Lord Viscount Goderich for his services in the chair.—The resolution was seconded by the Rev. Dr. HOOK, and carried by acclamation.—Lord GODERICH acknowledged the compliment.—Alderman BOTTERILL proposed the following resolution:—"That the thanks of this meeting be given to the distinguished visitors who have honoured us with their presence this evening."—This was seconded by Mr. EDWARD BAINES, who observed, in the course of his speech, that he could not but characterise this as the most brilliant assemblage that had ever been held under the auspices of the Leeds Mechanics' Institution.—The Earl of CARLISLE returned thanks for the compliment paid to the visitors, and the meeting separated.

NEWCASTLE.—Mr. W. G. Armstrong, of Elswick, through Mr. Dees, the treasurer, has intimated to the committee that he has placed £1,200 at the disposal of the Literary and Philosophical Society, to be applied to the erection of a reading-room.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 1, 1858.]

Dated 5th August, 1858.

1778. J. Luis, 1B, Welbeck-street, Cavendish-square—A new waterproof tube without seams or rivets, and in the apparatus connected therewith. (A com.)

Dated 7th August, 1858.

1800. J. Luis, 1B, Welbeck-street, Cavendish-square—A new twisting bobbin. (A com.)

Dated 26th August, 1858.

1930. W. Evans, Sheffield—Imp. in machinery or apparatus for manufacturing saw backs.

Dated 30th August, 1858.

1962. B. Hanson, Paddock, near Huddersfield—Imp. in means and apparatus for sizing and drying woollen yarns for warps.

Dated 2nd September, 1858.

1994. J. Bleakley, Accrington, Lancashire—Imp. in apparatus for communicating between the guard and engine-driver of railway trains.

Dated 4th September, 1858.

2008. D. Andrew, Greenock—Imp. in apparatus for obtaining motive-power.

Dated 9th September, 1858.

2040. W. Prisley, 7, Townley-place, Brandon-street, Walworth—Advertising by day or night.

Dated 10th September, 1858.

2052. J. Knowles, Bolton-le-Moors, Lancashire—Certain imp. in machinery for preparing cotton and other fibrous materials.
2056. F. A. E. Guironnet de Massas, Gerrard-street—An improved machine for decorticating and cleaning grain and seeds.
2058. D. Cheetham, Rochdale—Imp. in machinery or apparatus for preparing for spinning, and spinning cotton, wool, and other fibrous materials.

Dated 11th September, 1858.

2060. P. Journet, Paris—An improved toy.
2066. J. L. Hinks, Birmingham—A new or improved tap or cock for drawing off and filtering liquids.
2068. W. H. Manning, Devizes—Imp. in candlesticks for holders.
2070. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of soda and potash.

Dated 13th September, 1858.

2072. G. Flagcollet, Vagney, France—Imp. in self-acting mules.
2074. C. W. Siemens, John-street, Adelphi—Imp. in refrigerators, and in the treatment of the freezing or cooling material or materials used therewith.
2078. J. W. Towell, Regent-street—An improved helmet.

Dated 14th September, 1858.

2080. W. Riley, Bradford—Certain imp. in looms.
2082. J. Luis, 1B, Welbeck-street, Cavendish-square—Coke and gas kilns. (A com.)
2086. R. Lakin, Ardwick, and J. Wain, Manchester—Imp. in spinning mules and other machines of that class, used for spinning cotton and other fibrous substances.
2088. S. St. Clair Massia, Pall-mall—Imp. in stoves or fireplaces. (A com.)

Dated 15th September, 1858.

2090. Capt. F. Fowke, R.E., Park-house, South Kensington—Imp. in fire-engines.
2092. E. Dorsett, Old Broad-street—A portable carriage tank and furnace, to be employed for the purpose of creosoting hop poles or other timber.

Dated 16th September, 1858.

2095. G. Redford, Moseley, Worcestershire—Making cartridges of metal or gutta percha, with or without bullets, and for other purposes.
2096. R. Allison, Gravesend—Imp. in apparatuses for boring and sinking.
2097. W. P. Struvé, Swansea—Imp. in apparatus for indicating strains on engine ropes or chains.

Dated 17th September, 1858.

2099. C. F. Vasserot, 45, Essex-street, Strand—Machinery or apparatus for dressing and finishing fabrics. (A com.)
2101. E. Welch, Saint John's-square, Clerkenwell, and J. Biggs, Norton Folgate—An improved tobacco-press.
2103. J. H. Gresham, Kingston-upon-Hull—Imp. in copying letters, invoices, and other writings.

Dated 18th September, 1858.

2105. J. Luis, 1B, Welbeck-street, Cavendish-square—Imp. in the application of gutta-percha for clogs, galoches, shoes and boots, and for the apparatus connected therewith. (A com.)
2107. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derbyshire—Imp. in the manufacture of wrought-iron beams and girders.
2109. A. Turner, Leicester—Imp. in looms for weaving.
2111. T. Vicars, senr., T. Vicars, junr., T. Ashmore, and J. Smith, Liverpool—Imp. for the consumption of smoke in moveable furnaces or chauffers, for heating bakers' and other like ovens.

Dated 20th September, 1858.

2113. H. Barrow, Birmingham—An imp. or imps. in cartridge boxes.
2115. E. Riepe, Sheffield—An imp. in the casting of steel.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2128. F. F. Emery, Massachusetts, U.S.—An improved sewing machine. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Oct.* 1, 1858.]

September 30th.

496. A. Porecky.
579. L. Cowell.
673. T. Silver.
686. J. Mercer.
687. F. Edwards and W. Edwards.
701. C. G. Russell.
702. T. F. Robinson.
710. J. Fowler, jun.
713. H. Cartwright.
722. J. Smith.
724. S. Fox and J. Chesterman.
735. D. Davy, W. Bentley, and J. Davy.
740. E. P. Sibille.
743. W. A. Gilbee.
745. W. Armitage and H. Lea.
750. J. Doherty.
751. C. F. Whitworth.
754. J. Cartwright.
755. G. Davies.
756. G. E. Taylor.
757. G. Rowland.
758. F. W. Mowbray and J. Broadley.
762. T. Greenwood and J. Batley.
765. W. R. Jackson.
767. H. Bayley and J. Greaves.
771. R. M. Ordish.
772. A. Lees and D. Schofield.
776. J. Oxley.
777. S. T. Parmelee.
784. J. Rae.
785. A. C. Thibault.
813. A. V. Newton.
815. F. Preston and W. McGregor.
821. J. Harris & T. Summerson.
825. P. Brotherhood.
847. W. Latham
852. W. Bullough and J. Harrison.
864. R. Peacock.
870. J. Adkins and T. O. L. Buss.
888. H. A. de Saegher.
895. T. Greenshields.
909. W. A. Clark.
936. W. Keiller.
982. C. Schleicher.
993. D. Thom and G. A. Phillips.
1004. M. Davis.
1010. T. W. Thacker.
1126. J. Copcutt.
1179. J. Luis.
1198. S. Osler.
1236. J. Luis.
1328. G. Bartholomew.
1386. R. Winans and T. Winans.
1387. R. Winans and T. Winans.
1388. R. Winans and T. Winans.
1389. R. Winans and T. Winans.
1526. G. A. B. Chick.
1641. J. von N. S. Petrziwalsky.
1692. T. Line.
1738. G. T. Bousfield.
1801. J. Luis.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Oct.* 1, 1858.]

September 27th.

2166. R. Robey and G. L. Scott.

September 29th.

2180. C. Radcliffe.
2184. W. Kempe.

[*From Gazette, Oct.* 5, 1858.]

October 1st.

2198. J. Bernard.
2227. W. Spence.

October 2nd.

2209. R. Wilkinson.
2230. T. Dickens.

Journal of the Society of Arts.

FRIDAY, OCTOBER 15, 1858.

WRECKS AND CASUALTIES ON AND NEAR THE COASTS OF THE UNITED KINGDOM.

The Board of Trade has lately published its report under this head, compiled from returns received from the officers of the Coast-Guard, and receivers of wrecks, stationed on the coast of the United Kingdom.

The wreck experience of the year is stated to be *favourable*, but nevertheless the wreck chart, on which are laid down the localities at which the losses and casualities have occurred, and facts stated in the report, exhibit a state of things calling for serious consideration.

The tables show that there were wrecks and casualties, on and near the coasts of the United Kingdom, to the number of 1,143, representing a tonnage of 218,570 tons, and employing 9,819 hands. Of these 1,143 ships, 923 were British, and 220 foreign. The months in which the casualties took place are given as follows:—

	Vessels.
January	281
February	64
March	166
April	76
May	33
June	34
July	33
August	75
September	66
October	135
November	94
December	86
Total	1,143

The whole of the wrecks and casualties for the year are thus classed:—

Ships totally lost, exclusive of those lost by collisions	384
Totally lost in collisions	53
Seriously damaged	482
Damaged seriously in collision	224
Total	1,143

Thus the total wrecks are more than one a-day.

Of the 384 ships totally lost, 205 were wrecked from stress of weather, 66 from inattention, carelessness, or neglect, 34 from defects in the ships or their equipment, and 79 from various causes not classed.

The 482 cases of serious damage appear to have taken place under the following heads:—266 from stress of weather, 86 from inattention, carelessness, or neglect, 38 from defects in ships or their equipments, and 92 from various causes not included in the foregoing classes.

The returns show that of the total number of persons on board ships to which casualties happened, the lives of 2,206 were imperilled, 532 of whom or 24·11 per cent. were lost.

The following is the classification of the certificates held by the masters of the ships:—

Number of vessels commanded by masters holding certificates of competency—(Home trade)	79
Do. do. do. (Foreign trade)	133
Do., holding certificates of service—(Home trade)	198
Do. do. do. (Foreign trade)	97
Do. in coasting trade—masters not required to have a certificate	335
Do. commanded by masters, whether holding any and what certificate unknown	103
Do. commanded by foreigners not holding British certificates	198
Total	1,143

The report shows that the number of vessels insured was 599, at an aggregate sum of £451,513, but that 84 cargoes only were insured for £21,622; 179 vessels and 118 cargoes were reported uninsured, and of 365 vessels and 741 cargoes it is not known whether they were insured or not; 200 were in ballast. The estimated value of vessels and cargoes reported lost or damaged is stated as follows: 507 vessels, £393,859, cargoes 169, £125,442; total, £519,301. These are but approximations, the information not being complete. The following table shows the employment of the vessels lost last year:—

	Vessels.
In ballast, not colliers	138
Coal laden	382
Colliers in ballast	62
Cotton	8
Fishing smacks	15
Fish or oil	20
Grain and provisions	90
General cargo	85
Iron and other ores	88
Manure and kelp	15
Passengers	21
Potatoes or fruit	16
Salt	38
Sugar, coffee, spices, tea, molasses	10
Stone, slate, lime, or bricks	50

The site of each wreck is given in the chart which accompanies the report, and the following is a list of the principal points at which the casualties have occurred:—

Abertay	2	Kish Bank	1
Arklow Bank	2	Long	18
Barber	2	Long Scar	3
Blyth Sands	1	Maplin	3
Brake	2	Middleton	8
Burbo Bank	1	Nash	3
Cardiff Sands	1	Newcombe	2
Corton	2	Owers	2
Dogger Bank	1	Scroby	8
Dudgeon	5	Sunk	3
Galloper	4	Shipwash	5
Goodwin	18	Swin	1
Gunfleet	5	Tetney	1
Hasborough	4	Whitburn Steel	1
Herd	10	Whiting	1
Holm	10	Woolpack	1
Kentish Knock	3		

The table below shows the wrecks and casualties for 1857, compared with the five preceding years:—

Description of Casualty.	Total No. of Wrecks reported in the years 1852.	1853.	1854.	1855.	1856.	1857.	Total No. in 6 Years.	Average.
Wrecks	958	759	893	894	837	866	5207	868
Collisions	57	73	94	247	316	277	1064	177
Total	1015	832	987	1141	1153	1143	6271	1045

From this Table it will be seen that the wrecks and strandings reported in 1857 show—

A decrease of 9·6 per cent. as compared with 1852.
An increase of 14·1 per cent. as compared with 1853.
A decrease of 3·02 per cent. as compared with 1854.
A decrease of 3·02 per cent. as compared with 1855.
An increase of 3·47 per cent. as compared with 1856.

And that the Collisions reported in 1857 show—

An increase of 385·96 per cent. as compared with 1852.
An increase of 279·45 per cent. as compared with 1853.
An increase of 194·68 per cent. as compared with 1854.
An increase of 12·15 per cent. as compared with 1855.
A decrease of 12·34 per cent. as compared with 1856.

It appears from an inspection of the tables given in the report, that the casualties "on the East Coast during 1857 are 94 in advance of those which occurred on that

coast in the preceding year—or 52·5 per cent. upon the *whole* number of casualties on the entire coasts—a very large proportion. This may, in some measure, no doubt be attributable to the great number of vessels passing and repassing along that coast; but the chief causes appear to be—the difficult and intricate navigation incidental to the rocks and sands with which that coast abounds, the want of harbours of refuge, and the dangerous system of 'follow the leader' constantly practised by colliers and coasters, whereby reference to charts, the use of the lead, and the necessity for laying down courses are neglected.

The report goes on to say:—

"A diminution appears in the number of casualties by collision, viz., 277 in 1857, against 316 in 1856. The usual causes, 'neglect to show light,' 'bad look-out,' and 'misapplication or neglect of the rule of the road at sea,' still predominate largely. Another prominent cause of collision is the difficulty of making out the way in which a ship is standing by the showing of a single bright light. The application of coloured side-lights to sailing vessels, similar to those now used by steamers, will enable a vessel to distinguish the direction in which another vessel is standing, which a single light could never do.

"The means for saving life have received considerable attention and support. There are now stationed on the coasts of the United Kingdom, 66 life-boats belonging to the Royal National Life-Boat Institution, the whole of the coxwains and crews being exercised and maintained at the expense of the Board of Trade, and paid through that Institution. The above 66 boats are in addition to the life-boats belonging to private persons, corporate bodies, and local committees unconnected with the Board of Trade, and to two boats belonging to the seamen at Hartlepool subsidised by the Board."

The sum of £1049 7s. 5d. has been expended by the Board of Trade, during the past year, for the maintenance of life-boats alone. A new arrangement for giving increased efficiency to this branch of the Service has just been concluded with the Institution, and a sum of £827 15s. 4d. has been paid to assist them in placing some new boats in situations where they were much required.

The rocket and mortar apparatus has been put in a state of efficiency. The whole of the Inspecting Commanders of Coast Guard have been communicated with on this subject, and their recommendations with reference to making such changes in the apparatus as would in their opinion adapt it to the several localities, or as to the placing of new sets of apparatus where none had previously existed, have been carefully considered and in many cases carried into effect with satisfactory results. The method of landing persons from ships in distress by means of the rocket and mortar lines has been much simplified; a uniform plan has been devised and adopted, and directions for the use of the apparatus have been extensively circulated throughout the British and Foreign merchant services. The sum expended by the Board of Trade on this account during the year is £2,751 15s. 11d., and 243 lives have been saved through its instrumentality during the same period. The total sum expended in providing means for the salvage of life on the coasts of the United Kingdom, and as rewards for meritorious services on that behalf, during the year 1857, is £5,020 14s. 3d., which sum includes the amounts already referred to as having been paid in respect of life boats and mortar and rocket apparatus; but it is exclusive of the amount expended in presenting chronometers, telescopes, and medals for individual acts of courage and humanity performed in saving and protecting the lives of persons in distress at sea.

The wreck chart shows by distinguishing marks the stations where the rocket, mortar, and life-boats are placed.

There are 141 life-boats, 66 of which are under the management of the National Life-boat Association, and 75 under other management.

There are 198 stations where the rocket and mortar apparatus is placed belonging to the Board of Trade, and under the management of the Coast Guard. These are distributed thus: England, 141; Ireland, 34; Scotland, 23.

The number of lives saved were as follows:—

By the Life-boats of the National Life-boat Institution and local bodies	398
By luggers, coastguard-boats, and small craft	512
By ships and steam-boats	507
By assistance from shore with mortar and rocket apparatus, ropes, &c.	243
By individual exertion	8
Total	1668

THE SALT TRADE.

The following memorial of the salt proprietors of Cheshire and Worcestershire united under a Chamber of Commerce for the extension and protection of the salt trade, has been presented to the Earl of Malmesbury, Secretary of State for Foreign Affairs:—

"Looking to the present state of our relations with China, and to the changes which may be expected to result from the negociations now going on there, your memorialists respectfully urge that an opening for British manufactured salt may be obtained at the various trading ports of that vast empire.

"Your memorialists cannot adduce any reliable statistics of the actual consumption of salt in China, but assuming the population at three hundred millions, it must range between one and two millions of tons. Your memorialists know that the Chinese sources of supply yield at present no tribute whatever to British commerce, whilst a most vicious fiscal system, dreaded and detested by the population of China, (a system which free admission of British salt would most effectually destroy,) compels the use of an impure and deleterious article.

"Your memorialists impress on your lordship the vast advantage to be derived by British shipping and British commerce, from additional bulky articles of export to China.

"Your memorialists also point to the success which has attended the partial admission of British salt into India, and although restricted to the single port of Calcutta, one hundred thousand tons are now annually imported there, thus furnishing an aggregate of cargoes for 100 ships of 1,000 tons each, with one hundred and fifty thousand pounds per annum in freight, when previous to the small concession of bonding facility obtained from the East India Company in 1846, no British salt found its way to India.

"Your memorialists are convinced that, independent of the great blessing the poorer natives thus derive from the use of pure salt, the beneficial re-action upon the consumers of sugar and other comestibles in Great Britain is considerable, as it affords opportunities to traders and shipowners of bringing these articles in greater abundance, and at a cheaper rate of carriage to England.

"Your memorialists further observe that, as the balance of trade with China is largely against this country, owing to our heavy imports from thence of tea and silk, it is highly desirable that our means of paying for such necessaries should be increased, by shipments of manufactured articles, so as to lessen the necessity for the large drain of specie hitherto required to carry on our trade with China.

"On these important grounds your memorialists would therefore respectfully entreat that free admission of British salt be made a stipulation in our future dealings with the Chinese authorities, a concession which, whilst

it would bring home to the poorest household in China the palpable superiority of British produce, would also greatly assist in removing those barriers of ignorance and of prejudice which have hitherto been so detrimental to the prosecution of enterprise with the Chinese people; and the most practical illustration that the cheap salt of this country is able to cope effectually with solar-made salt, notwithstanding the freight paid to British shipowners, is afforded by the fact of what has been accomplished in the Calcutta market."

The same body have also agreed upon the following memorial, to be presented to Lord Stanley, President of the Council for India:—

"That repeated representations have been made by the salt trade, addressed both to the late Honourable East India Company, and to Her Majesty's Government for the time being, upon the benefits likely to attend the full admission of British manufactured salt into the ports of India.

"That under a reconstruction of the fiscal system hitherto existing in India, which may be expected to follow the great political changes that have taken place there, an adjustment of the Salt Duties and extended arrangements for the admission of British salt into India are, in the opinion of your memorialists, objects deserving of especial consideration.

"That the privilege of importing British salt into India was only conceded practically in the year 1846, and it has been so far successful as, gradually, to lead to an import of nearly one hundred thousand tons at the port of Calcutta, where alone facilities exist under which the salt can be bonded and sold.

"That this opening of the Calcutta market establishes the fact of good British salt with the freight added being enabled to compete with native and other Asiatic-made salt, inasmuch as the cheapness and purity of the former more than counterbalances the cost of transit; and hence an additional article of export, affording an outlet to our native manufacture and profitable employment for shipping, has been secured, creating at the same time an additional demand for Indian produce in return.

Your memorialists need hardly point out to your lordship the advantage to a population like that of India having access to a supply of good wholesome salt, instead of being compelled to use the inferior native made salt, which has heretofore alone been within their reach; and your memorialists confidently believe that if bonding facilities are afforded at all the ports similar to those which exist at Calcutta, British salt would soon find its way into every part of India.

"Your memorialists would therefore most respectfully urge, as regards the treatment of English salt, that all Indian ports be placed upon the same footing relatively with the native manufacture as Calcutta, due regard being had to the differential duties which appear to exist in the different Presidencies, and that an early intimation should be given to your memorialists when such extended facilities are likely to come into operation."

The salt trade of Cheshire and Worcestershire comprises some fifty or sixty firms (amongst them several joint-stock companies, in which many hundred thousands of capital have been embarked), who now manufacture upwards of a million tons of salt per annum, affording employment to a large number of labourers and artisans —contributing £50,000 per annum to the River Weaver Trust, besides many thousands to the railways, and a large sum to the Liverpool Dock rates,—capable of almost unlimited extension as regards quantity, and of thus developing a large and valuable property. The salt proprietors contend that it is a trade well deserving the support of the Executive—and that so favourable an opportunity as presents itself for testing the Chinese markets should not be lost sight of—to say nothing of the importance of the question to the shipping of this country. The total export of salt from Liverpool last year was 624,496 tons, of which 80,312 tons went to Calcutta. This is exclusive of exports from the ports of Bristol and Gloucester.

BRITISH ASSOCIATION, LEEDS, 1858.

On the Economy of Water-power. By Joseph Glynn, F.R.S., M.Inst.C.E.

The following paper was read before the Mechanical Section:—

Although much has of late been done to facilitate and extend the employment of water as a moving power, the worthy president of this section having greatly improved his water wheels so as to obtain an increase of useful effect, and to obviate the drawbacks to which they had been subject, by means of ventilating buckets and other inventions connected with that method of applying water-power; and although several modes of applying water-pressure as a moving power have been much improved, and its use greatly increased by the inventions of Mr. Armstrong, of Newcastle-on-Tyne, for accumulating and distributing the pressure of water for working cranes, for opening dock-gates and bridges, and for other purposes where great power is required occasionally or at intervals; although he has greatly improved the pressure engine, and caused water to do duty instead of steam, and has even economised the surplus pressure of the water as it passes through the main pipe in the streets of Newcastle, causing it to print a daily newspaper before he parts with it, and, as it were, to pay a transit duty to Newcastle on its way to Gateshead, yet much remains to be done in the employment and economy of this great source of mechanical power so beautifully distributed over the three kingdoms.

Those members of this section who visited Paris during the Great Exhibition, would probably observe the various methods of applying water as a motive power which were there displayed, some of them in the form of models, but others as powerful machines intended for actual work, and capable of driving several pairs of millstones.

In this part of England, and in other manufacturing districts where coal is found, the steam engine will generally be preferred to all other prime movers, but in many parts of the British empire, more especially in Scotland and Ireland, coal is scarce and water is abundant, and is too often allowed to run to waste when its application to turn mills and to work machinery for farming purposes might save both time and money, and relieve the people from the burden of hard work that can be better performed by mechanical power than by manual labour.

Those machines produced at the Paris Exhibition, to which the writer would more particularly direct the attention of this section, are the horizontal water wheels, some of which were wrongly named turbines, whereas they were really substitutes for the machines so called.

The turbine is a machine of re-action, on the same principle as Dr. Barker's mill, or that modification of it known as Whitelaw and Stirrat's Water Mill, from which the water issues in jets, and the unbalanced pressure opposite to the orifices impels the machine, and causes it to revolve in the opposite direction, somewhat in the same way that a skyrocket is driven upwards by the force or recoil acting against the closed end of the rocket tube or case.

The name turbine is derived from the supposed resemblance of these machines to a twisted or turbinated shell. The turbines of M. Fourneyron and others are formed on this principle of re-action, having their curved vanes somewhat similar to the twisted shell.

The turbine requires considerable skill in its construction, and careful attention when it is in use; but the horizontal water-wheel is a much more simple machine, and much less liable to derangement. It is not a costly machine, and it requires comparatively little care.

These horizontal wheels are much alike in principle and in plan, although they may and do differ from each other in their details, and they also differ materially from the vortex-wheels which Mr. James Thomson well-described in an excellent paper read before this section at the meeting of the Association in Belfast, illustrated by diagrams showing their construction, which may be compared with that of Appold's pump with its action reversed. The water drives round a fan with curved vanes, having a vertical axis, and revolving in an iron case, the water escaping at the centre.

The horizontal water-wheels in the French Exhibition were much alike in principle and in plan, although they might differ from each other in their details. They generally consisted of two parts or wheels placed horizontally on a vertical axis, one wheel immediately above the other. The upper part or wheel is fixed, and serves to direct the water into the buckets of the lower one, that is to say the real water-wheel, which revolves, and the axle or spindle revolves with it.

If the fall or head of water be but little and the quantity of water large, the machine is generally fixed in masonry, but if the fall be great and the quantity small, it is generally fixed in an iron cylinder, sometimes closed at the top; the water being then brought into the side by an inclosed pipe descending from the elevated sources of the water.

The regulators which determine the quantity of water and the speed of the wheel may vary in almost every instance, some being mere wooden sluices, some being metal plates pierced with apertures like a ventilator, and some of stout leather strengthened with iron plates; the leather being in three pieces, and fitted upon conical rollers radiating from the axis.

Some of these wheels are very powerful and carry a spur wheel upon the vertical axis, surrounded by six pairs of millstones for grinding corn, driven by pinions in the usual way. Other wheels, of smaller size and greater speed, drive a single pair of millstones without the intervention of other mechanism; the axis of the water wheel being also the spindle of the millstone.

The mechanical effect of these machines when carefully made is said to equal that of an overshot or breast wheel. Messrs. Fromont state that some of their making realize 75 per cent. It is somewhat singular that those wheels which some of our engineers and mill-wrights now make for exportation, should not be used at home. The well-known firm of Bryan Donkin and Co., of London, may be mentioned as the principal makers and exporters of the horizontal wheel.

The writer has been induced to submit to the section the waste of water in so many places where it may be turned to profit, from his having recently visited some of the undulating and hilly counties bordering on Wales, where almost every valley has its stream or brook ready to do good service, and the means of making such power available at moderate cost.

On an Expanding Pulley. By J. Combe.

The following paper was read before the Mechanical Section:—

A pretty correct idea of this pulley may be formed by supposing two cones cut with radial spaces alternating with solid parts, so that the solid parts in one may slide freely into corresponding spaces in the other, in the direction of a common axis. The sizes of these radial sections are regulated so that when the two cones are put together they form a grooved or V pulley, the diameter of which varies according to the position which the cones occupy with regard to each other.

This will be at once apparent by an inspection of the models or drawings. It will also be seen that any desired amount of variation in size may be got, and this without involving the necessity of occupying a large space. This change in size is made by pressing the one into the other, which can easily be done whether the pulley be in motion or at rest. The value of the property of giving readily any amount of change in size, will be made evident, by a comparison of the results obtainable by a pair of common cones and a pair of expanders, of similar dimensions, and giving the same extremes of speeds.

A range, from one to four in diameter (or more if necessary), is easily obtainable in the expanders, and supposing the one which drives to have a speed of 80 revolutions per minute, and that it be set at 4 inches diameter, and the one which is driven to be set at 16 inches diameter, (the corresponding position,) the speed of the latter will be one-fourth of 80, or 20 revolutions per minute. When the driver is changed to 16 inches diameter, and the driven to 4 inches, the speed of the driven shaft will be increased to 320 revolutions per minute.

The changes between these extremes (20 and 320) may be of any extent, or per centage on the speed, and they can be made as gradually as is desired without stopping.

For comparison with this, take a pair of common cones, having the same extreme diameters, and having steps of two inches, which is not more than usual. When the driving strap is changed from the steps on the cones, which give the slowest speed (that is 20 revolutions per minute) to the next steps, which is the smallest change that can be made, the speed of the driven is increased to 34 revolutions per minute, that is 70 per cent. on the former speed. The change to the next steps makes the speed of the driven 53, and the increase here is 56 per cent. The third change increases it to 80, or 51 per cent. The next to 120, an increase of 50 per cent. Then to 186, by an increase of 55 per cent. And, lastly, to 320, by an increase of 72 per cent. All these changes in speed are great, and although in practice mechanics have become accustomed to them, and don't think of the loss, it is quite clear that a great waste of time must result from not being able to get smaller changes readily. For instance, suppose that a lathe or boring machine has a piece of work in it of a diameter that would require a speed between any of the speeds which the steps of the common cones give, but which will not bear the whole step, it is quite clear that in this case a loss of time and work equal to 50 or 60 per cent. may take place. To get over the difficulty attending the use of common cones, some tool makers use two pairs of driving pulleys on the counter shaft, which of course doubles the range of the cones, but this is a cumbrous arrangement, and is still very far from giving what is necessary or desirable. There are many machines in which a variation of speed is desirable, and would be used if it could be got readily; but there is often such a loss of time involved in making a change that very much slower speeds are used rather than take the trouble or incur the delay of making that change. The common cones referred to are not by any means an extreme case; on the contrary, it is quite common to make the steps even greater, and if the number of steps be less, and the extent of the range smaller, there is of course a corresponding diminution in the adaptability of the machine to different purposes.

The expanding pulley was first brought out for the purpose of giving the varying motion to the bobbins in flax and tow roving frames, to which it is applicable with great advantage, from the accuracy of its action and the small space which it occupies. By its use a very simple and correctly working machine is got, capable of making bobbins either in the ordinary way or in cops. It is equally applicable (as the cop and bobbin exhibited will testify) to the heaviest and the lightest frames.

The cop is from a tow roving frame, and is made of rove weighing 1 lea (or 300 yards) to the pound. The bobbin is filled with flax rove of 40 leas (or 12,000 yards) to the pound.

On the machines on which this bobbin and cop were filled, only one expander is used, and the band is kept at the necessary tension, either by making the expander swing in a frame, or by the use of a stretching pulley.

A very simple mode of applying a stretching pulley is to make the pulley, which does not vary, with two grooves or V's, and pass the band twice round it, putting the expander in one fold, and the stretching pulley in the other. These arrangements are applicable to many other purposes. Where two expanders are used one to drive the other, it is not necessary to have any stretching pulley, but simply to connect one or both sides of each pulley with levers, so that they may be moved simultaneously as required.

The purposes to which these cones are applicable are innumerable, and being simple and inexpensive, there is every reason to expect that when known, they will be almost as extensively used as common flat pulleys. It is thought by many that V pulleys and bands for driving purposes are objectionable, but there is some prejudice in this idea. If a round or square band will convey the power, last as long, and not be more costly than a strap, where are the objections? It has been long known that round gut bands can convey great power, and their durability and economy soon speak for themselves. There is a gut band here which was in constant use on a 60 spindle roving frame for seventeen months, and it is as good now as when it was put on, or nearly so. In such a frame, made in the ordinary way with two cones, a strap 2½ or 3 inches broad would be used.

From the great range in size which can be got with these pulleys, and the keen bite which the bands take, they are exceedingly applicable to tools of all kinds.

As an instance, a drilling machine made by Messrs. Buckton and Co., in the "Exhibition of Local Industry," now open in Leeds, may be referred to, in which, by means of a pair of these pulleys, which can be changed from 4 to 16 inches diameter, any variation of speed can be got at once from 20 to 30 revolutions per minute, or other range in a like proportion. In this machine the usual bevel wheels are made two to one in place of being equal in size, and it has no other gearing; it will, however, do nearly as great a range of work as double-geared machines of similar size. The cost is less, and the facility of change much greater.

To lathes it is equally applicable, and its peculiar adaptation to those for surfacing will be obvious.

A governor driven by it can be made to regulate an engine or water-wheel at any desired speed without stop or trouble.

It is also extremely well adapted to give the varying speed required in weaving machines, such as dressing, warping, and winding machines, and for positive giving-out and taking-up motions in looms.

These pulleys have now been in use extensively for about two years for roving frames, and can be spoken of with confidence as to their performance and value. For most purposes a round band answers very well, but where a considerable power is wanted to be transmitted, bands formed of two or more thicknesses of leather can be used.

In conclusion, it may be stated that the liability to accidents is very much diminished as it is not necessary for the attendant to touch the band while changing the speed.

On the Application of Combustible Compounds to be used in War. By J. Macintosh.

The following is an abstract of a communication read before the Mechanical Section:—

This paper relates to the use of coal tar, naphtha, or other hydro-carbons, alone or in combination with other materials, to be used as an agent in attack and defence; also to the application of hydro-carbons mixed with gunpowder, and brought to a plastic state by means of India-rubber or other gums, and fibrous materials, introduced into shells and other missiles; also in filling shells with coal-tar naphtha, containing potassium, for igniting when used in water, and in filling shells with coal-tar naphtha, mixed with phosphorus and bisulphuret of carbon, with bursting powder sufficient to open the shells.

To attack fortresses from seaward, an artificial dense and dark fog is generated, capable of being prolonged at pleasure, in front of the batteries to be attacked, which renders them untenable, enabling the attacking vessels to approach and destroy the works, unmolested by any hostile fire.

The diaphragm shells, filled with naphtha, phosphorus, and bisulphuret of carbon, may be used with great effect against cavalry and troops, as the bursting of the shell scatters the contents in all directions, causing their immediate disorganisation and destruction. When a shell containing the combustible material bursts in earthworks, the earth, being porous and incombustible, prevents the combustion from spreading rapidly, but allows the black vapour to ooze out gradually, causing most serious annoyance to the enemy, who are unable to extinguish the suffocating fog, and are hindered from carrying on their operations.

It may be brought to bear with most satisfactory results against an enemy encamped in tents.

Plan for Giving Alarms in Passenger Trains. By J. O'Neil.

The invention consists of an iron bar extending under each carriage, and suspended on a pin a little from the centre, so as to make one end heavier than the other.

The heavy end is securely held in a bridle, by a hanging latch at the end of the carriage.

The light end also passes through a bridle at the other end, and has a tongue which draws out from the bar, and reaches under the latch fixed on the next carriage.

By disengaging any of the latches, the heavy end falls; and the light end, in rising, throws up the next latch, and so on to the guard's van, where it rings an alarum.

A chain or wire, fixed to the latch and brought into the carriage, gives each passenger, in the event of danger, the means of giving a signal to the guard; and a duplicate set of bars, on the other side of the carriage, enables him instantly to communicate with the driver, if necessary.

The end of each tongue has a rising point, rivetted loose, so that the porter, when coupling the carriages, could put it in position for disengaging the latch, in case the carriages should become detached by the breaking of the coupling chains.

As the bars are not connected, any number of carriages can be taken off or put on at a station, by merely turning the loose point on the end of the tongue up or down.

On some of the Results of the Society of Arts Examinations.—By John Pope Hennessy, of the Inner Temple.

The following paper was read before the Section of Economic Science and Statistics:—

The system of examination established by the Society of Arts is well known. I do not propose referring to it further than to remark that it is intended to operate among the working classes; that no students of any of the learned professions, no graduates or undergraduates of any university, no certificated schoolmasters or pupil teachers are eligible for examination. Nor is any one qualified to present himself as a candidate who is not a member of, or a student of a class in, one of the many Institutes in all parts of the United Kingdom in union with the Society of Arts. In this way it becomes a test of the influence of institutional education. In fact it is the only direct and unequivocal test of that valuable class of education which we possess. Statistics of an in-

teresting and useful kind have at various times been published with reference to the primary education of the working classes. Such statistical tables, however, refer to the period of school life; to the number of years spent at school and the age at which children leave school. The results of the Society of Arts examinations furnish a new class of educational facts. They deal with persons who have left the school for the workshop. They enable us to estimate the relative effects of different periods of school life. They enable us to estimate the effect which early removal from school has on that portion of the working population with which the system deals. In one of the printed forms of inquiry which each candidate at the final stage of the late examination was requested to fill up, the following questions were asked: "How many years were you at school? How many years have elapsed since you left school?" One thousand one hundred and seven candidates were examined this year, but as some of these were rejected at the preliminary examination, as others did not offer themselves for the final examination, and as some of the forms, as far as the mere educational statistics were concerned, were imperfectly filled, not more than three hundred and ten supplied the requisite information. The Council of the Society of Arts have kindly placed at my disposal all the documents referring to the examination. Neither the Council, however, nor any of the officers of the Society are answerable for either the statements of fact or the expressions of opinion which this paper contains. The first result at which I arrived was that the average period of the school life of the candidates was under that usually regarded by educationists as the normal and necessary period. Some of the ablest and most practical of Her Majesty's Inspectors of Schools have asserted that the normal period of school life is twelve years. Other educationists have estimated this period at nine or ten years; that being in fact the average duration of school life on the continent,—in Bavaria, Holland, Saxony, Prussia, Norway, Switzerland, Sweden, and many other countries. It will be seen from the following table that the great majority of the candidates were at school for a much shorter period:—

Under 1 year at school	13	9 years at school	21
1 year at school	2	10 ,, ,,	18
2 years at school	11	11 ,, ,,	1
3 ,, ,,	22	12 ,, ,,	7
4 ,, ,,	32	13 ,, ,,	0
5 ,, ,,	49	14 ,, ,,	1
6 ,, ,,	47		
7 ,, ,,	46		310
8 ,, ,,	40		

The average period was therefore 6.016 years or less than 6 years and 6 days. Although this period is much less than that which we are told should be the minimum duration of school life, nevertheless it is somewhat over the average in this country. Mr. Horace Mann shows that the average school time of all the children in England and Wales is, as nearly as possible, 5 years. At the Educational Conference held last year in London, this fact was spoken of as one of the most disheartening kind. That children should be only five years at school was regarded as an evil of the greatest magnitude. Some of the distinguished educationists present at the Conference did not hesitate to charge the employers of labour with destroying the intellect of the working classes, and with preventing all mental improvement amongst the people by drawing the children from school, when they had only spent five years, on an average, under the care of a schoolmaster. Some were even found ready to advocate, as a remedy for this theoretical evil, a system of compulsory education. Similar remarks have been made in Parliament. It has been in fact assumed, almost universally, that in five years little or nothing of any practical value could be learnt. I have, therefore, paid particular attention to this period, with reference to the results of the Society of Arts examinations. The conclusion to which I have arrived are precisely the reverse of those which, on ordinary theoretical grounds, and from the general tone of educationists, we should have anticipated. Taking all the candidates who only attended at school for 5 years, 4 years, 3 years, 2 years, 1 year, or less than one year, and calling them class I.; and taking all the candidates who attended school for 6, 7, 8, 9, 10, 11, 12, and 14 years, and calling them class II., I find that 129 candidates belong to class I., and that 181 candidates are included in class II. These candidates were each examined in a certain number of subjects, chosen from a specified list of 25 different branches of science and literature. There were, therefore, 25 candidates who obtained the highest places; and to 14 of these 25 were awarded 1st prizes. I find that the highest places in 15 subjects were obtained by the candidates in class I. That is, those who had attended school only five years or under, carried off two-thirds of the first places. Of the fourteen 1st prizes, eight were taken by candidates in the first class; and only six were left for those who had spent six years or more at school. The fifteen subjects in which Class I. carried off the highest places are Arithmetic, Algebra, Mensuration, Navigation and Nautical Astronomy, Statics, Dynamics and Hydrostatics, Practical Mechanics, Chemistry, Animal Physiology, Botany, Descriptive Geography, Physical Geography, English History, French, German, and Free-hand Drawing. The subjects in which those who had attended school for six years and over carried off the highest places, are Bookkeeping, Geometry, Trigonometry, Conic Sections, Magnetism, Electricity and Heat, Political Economy, English Literature, Latin and Roman History, and Mechanical Drawing. Candidates of each class were equal for the first place in Astronomy. In estimating the value of this result, it is necessary to remember that Class I. was numerically smaller than Class II.; the two classes being in the proportion of seven to ten. It therefore appears that, in proportion to the number of candidates in each class, those whose average period of school life was only 3 years 7 months, obtained more than twice as many of the highest places as those whose average school time was 7 years 8 months. Although this result is a fact, and, as such, is probably worth volumes of speculations on the theoretical aspect of the question, yet I do not think it can justify any positive conclusion of much value. Should it be confirmed by the experience of future years, and by a still more widely-extended inquiry, it may become a question whether institutional education—to which, as a matter of course, it is almost altogether owing—ought not to be regarded as a system of popular instruction coming as fairly within the scope of Parliamentary support as the elementary education in the schools under inspection. Without, however, at present justifying a positive conclusion of any great importance, it indicates the necessity of extreme caution in discussing the education question. It would appear to show, for instance, that no fair analogy exists between the school period of a country like England, where Mechanics' Institutions are established in every town, and countries like most of those on the continent where such institutions are not to be found. It would appear to show that youthful labour and early intercourse with the world may enlarge the mind and give additional force to intellectual exertion; and it would even appear to throw a doubt over all schemes—whether compulsory enactments or prize schemes—by which children would be kept at school and prevented from proceeding to work.

The average duration of the candidates' school-life, in various parts of the country, is exhibited in the following table. In the districts marked with an asterisk special prizes were awarded to Local Boards of Examiners and Institutions, in addition to those given to the candidates:—

Name of District.	Average School-period.
*Banbury	5 years 9 months.
Berkampstead	6 „ 9 „
Blackburn	4 „ 0 „
Bradford...	4 „ 3 „
Brighton...	8 „ 0 „
*Bristol	6 „ 8 „
Halifax	5 „ 0 „
Ipswich	6 „ 8 „
*Leeds	5 „ 10 „
Liverpool	6 „ 2 „
*Eastern District of London...	6 „ 2 „
Western District of London...	7 „ 6 „
Louth	6 „ 3 „
Macclesfield	5 „ 0 „
Manchester	5 „ 8 „
Oldham	6 „ 6 „
*Portsmouth (Portsea)	4 „ 3 „
Selby	7 „ 8 „
*Sheffield...	5 „ 6 „
Stockport	4 „ 6 „
Wakefield	6 „ 6 „
Wigan	5 „ 8 „
York	7 „ 3 „

SOLID INK.

M. Leonardhi, of Dresden, has invented an ink which he calls "Alizarine Ink," which he can form into cakes for convenience of transport. Liquid inks, hitherto formed into cakes by drying and evaporating, cannot be brought back to the liquid state again satisfactorily. The inventor takes forty-two parts of Aleppo galls and three parts of Dutch madder, and infuses them in a sufficient quantity of hot water. The solution is then filtered, and five and a half parts of sulphate of iron are dissolved in it, after which two parts of acetate of iron, and one and one-fifth part of liquid sulphate of indigo are added. The whole is then evaporated to dryness, and the residuum is moulded into cakes.

One part of this dry ink dissolved in six parts of hot water gives, says the inventor, an ink of first-rate quality, but one of good quality may be obtained by employing ten or fifteen parts of water to one of solid ink.

MANUFACTURE OF SALTS OF BARYTA.

A communication on this subject, by M. Frederic Kuhlmann, has recently been laid before the French Academy of Sciences, in which the author, after speaking of the important sanitary considerations involved in the subject, states that the experience of several years in his manufactories has enabled him to surmount many of the difficulties which at first stood in the way of the economical production of these salts.

The first object he had in view in his experiments was to lessen the cost of the acids, which form an important element in their manufacture, and to this end he endeavoured to condense more effectually the acid vapours, which usually escape to so large an extent in the works where sea-salt is decomposed by heat. This is effected by making them pass over native carbonate of baryta. The chloride of barium thus formed is converted into sulphate by the addition of sulphuric acid, the hydrochloric acid given off being again condensed and utilised. A large portion of the same acid, in combination with manganese, had also been hitherto unavoidably lost in the manufacture of chloride of lime, and many experiments had been made with the view of utilising the chloride of manganese thus wasted, but with very partial success. M. Kuhlmann, however, states that by a process which he describes, he is enabled to make use of this substance for the conversion of native sulphate of baryta into chloride of barium. Certain proportions of the native sulphate are mixed with chloride of manganese and charcoal, and after exposure to a very high temperature for some considerable time, insoluble sulphuret of manganese is formed, together with chloride of barium, which may be easily separated by washing. The reaction may be represented thus:—

$$\text{Ba O, SO}^3 + \text{Mn Cl} + 4\text{C} = \text{Ba Cl} + \text{Mn S} + 4\text{CO}.$$

The chloride of iron, which is generally found mixed with the chloride of manganese, undergoes similar decomposition. The charcoal acts as a deoxidizing agent, and is converted into carbonic oxide. Only 3 or 4 per cent. of the sulphate of baryta is said to be lost in this process.

M. Kuhlmann mentions that in repairing a furnace which had been employed in this operation, a blue substance, containing neither soda, manganese, nor cobalt, had been found, and he is of opinion that this is a kind of ultramarine in which the soda is replaced by baryta.

The production of artificial sulphate of baryta from the chloride of barium obtained in the manner described above, is effected by precipitation from the watery solution of chloride. After this has been purified, diluted sulphuric acid is added to it till no further precipitate takes place. The supernatant liquid is then drawn off by a syphon, and the precipitate, after being thoroughly washed, to remove any trace of free acid, is compressed into a paste, in which state it becomes an article of commerce. The author states that he now produces at his works as much as 2,000 kilogrammes per day, and that it has been much used in various kinds of painting, distempering, and whitewashing, and he is of opinion that as it enters slowly into very intimate combination with the soluble alkaline silicates, it may serve to facilitate the rendering other pigments permanent, as well as to form a remarkably pure white paint, not liable to be acted upon by sulphuretted hydrogen.

Proceedings of Institutions.

BRADFORD (MECHANICS' INSTITUTE.)—A soirée was held at this Institution, on Thursday evening, the 30th September, when the prizes and certificates awarded at the last examination of the Society of Arts were distributed. Tea was served in the news-room at half-past six o'clock, and the company afterwards adjourned to the lecture-theatre, where the Rev. J. H. Ryland, president of the Institution, took the chair at eight o'clock. R. Monckton Milnes, Esq., M.P., was present as an invited guest, and among other gentlemen on the platform were the Mayor of Bradford, the Rev. Dr. Goodwin, W. E. Forster, Esq., Alfred Harris, junr., Esq., — Tyler, Esq., J. V. Goodwin, Esq., Edward Kenion, Esq., the Rev. W. R. Smith, Dr. Brereton, and Messrs. Farrar, sen., Mills, and Yewdall, members of the Town Council. The PRESIDENT, in stating the objects of the meeting, made some remarks on the beneficial influence which the Society of Arts' examinations are likely to exercise upon Mechanics' Institutions, by giving them increased vitality, and adapting them in a greater degree to the wants of the people. He adverted to the meeting of the British Association at Leeds, and intimated that Bradford might hope to be honoured by a visit from that august body at some future time. When that time should come, he trusted it would be shown that, as Bradford, in its material interests, had far outgrown any other town, so it must take a foremost rank in the achievements of science and intellectual cultivation. The number of members of this institution had not been this year quite so great as in former years, owing to the depression of trade. Still he believed they reached about 1,200 in number. The number of books in the library was upwards of 7,000. The President then distributed the prizes of books awarded by the Institution

to the attainments of the pupils in its own classes, according to the system which was commenced in 1847 and had been regularly followed down to the present year. The award of these prizes was the result of examinations by the members of the direction and others. With reference to the Society of Arts' Examinations, the President stated that at the preliminary examination, 22 candidates, members of the Bradford Mechanics' Institution, presented themselves, of whom 18 satisfied the requirements of the Local Board. Of the 18 candidates who were examined by the papers of the Society of Arts at the final examination, 17 were successful, and received certificates.—Mr. Alfred Harris, junr., Chairman of the Local Board, then distributed the certificates. Special prizes, proposed by himself, were also distributed by Mr. Harris, to three candidates in drawing.—The President said he had received a letter from Mr. Lobley, the teacher of the drawing class, stating that the pupils in that class desired to return thanks to Mr. Harris for his generosity, encouragement, and advice during the past year. The Mayor briefly proposed the first resolution :—" That this meeting congratulates the members and friends of the Bradford Mechanics' Institute on the return of its winter session, as affording, in its various departments, renewed opportunities for the diligent acquisition of knowledge; more especially in the classes department, the importance and results of which have this evening met with public and appropriate recognition."—Mr. R. Monckton Milnes, M.P., seconded the resolution, and, in the course of his speech, offered some useful suggestions on the attainment of scientific knowledge by members of Mechanics' Institutions. Science was nothing but an active and careful examination of the works of nature around us. There was not one member of that Institution who did not come into contact with the operations of nature in one way or other in his various employments. By a careful study of those operations of nature, the first step in science was gained, and if they went from the operations of nature to those operations of applied science which were at the foundation of the great manufacturing processes in this country, they would then have learnt those principles of mechanical science which would lead them to subjects of the highest interest. Mr. Milnes said that the best thing which men of science could do to encourage the study of science in this country would be to simplify their vocabularies; but the two immense impediments to scientific inquiry were over-work and over-play.—Mr. W. E. Forster moved the next resolution : —" That this meeting desires to call the special attention of the members of the classes to the progress which the Society of Arts' scheme of Examination has made during the past year; and trusts that the success of this Institute in the recent examination may stimulate the pupils in its classes to increased exertion, in preparing for a similar examination in 1859." In reference to the Society of Arts' Examinations, Mr. Forster said that the success achieved by the candidates belonging to the Bradford Mechanics' Institution was greater than the average throughout the United Kingdom. He heartily congratulated them on that result, and hoped that next year it would be still more favourable. The Rev. Dr. Godwin briefly seconded the resolution.—Mr. Edward Kenion moved " That the members and friends of the Institute again express their great obligations to all such as give it the benefit of their gratuitous services in the instruction of its classes."—Mr. Hanson seconded the motion.—Mr. J. V. Godwin moved a vote of thanks to the President, for his conduct in the chair; the motion was seconded by Mr. Farrar, and carried with acclamation. The proceedings of the meeting were interspersed with vocal music, by Mr. Sunderland, Miss Newbound, and Mr. Briggs: Mr. Jackson presiding at the pianoforte. The whole concluded with " God save the Queen."

Crosby-hall Evening Classes, London.—On Thursday evening, September 30th, a public meeting of the members and friends of the Evening Classes for Young Men was held in Crosby Hall, Bishopsgate-street, with the special object of distributing the certificates and prizes which were awarded to the members of that Institution by the Council of the Society of Arts, after the Examination in May last. The chair was occupied by T. Winkworth, Esq., one of the Vice Presidents of the Society of Arts; and he was supported by the Revs. F. G. Blomfield, Thomas Hugo, R. M. Martin, Dr. Zerffi, D. Blenkarne, Esq., the Honorary Secretaries, &c. The Prizemen also had seats on the platform. The Chairman expressed his regret that no more distinguished person occupied the chair on that occasion, though he felt great pride and satisfaction in representing the Society of Arts. He took the strongest interest in the operations of this Institution, which had earned so many certificates and so many prizes; and he had no doubt that the company present would make allowances for him if he failed in properly conducting the business of that evening, though he had little apprehension, as he was so well supported by the Committee and acting officers of the Institution.—The report of the proceedings for the last session was then read, from which it appeared that—

At Midsummer, 1857, there was considerable anxiety as to the prospects of the Institution. There was a considerable debt on the Institution, and the tenants of Crosby Hall had notice to quit, as the lease of the building was to be sold. A great exertion was accordingly made. Proposals were issued to raise by subscription a considerable sum, with a view of paying off old liabilities, and, if possible, of purchasing the lease. Some changes were made in the constitution of the committee, and an Endowment Committee was also appointed, who, having set apart a sum to pay off existing liabilities, endeavoured to treat for the lease of the building; but as the price set upon it far exceeded their means, they took steps to retain at least temporary possession at the same rent as heretofore. By this means the Institution was set free from its difficulties; and being thus secure as to the payment of its rent for a year or two, and relieved of its heavy incumbrances, it has been able to continue its work. During Michaelmas Term, 1857, there were 672 subscribing members, producing the amount of £262 0s. 6d. The returns of Lent and Trinity Terms were somewhat similar, as may be seen by the following table, only the receipts were not so large, as the Michaelmas account includes members who then subscribed for the whole year:—

Lent Term, 1858: Members, 70; Subscription,	£223	0	0
Trinity Term, 1858: Members, 50; Subscription,	£180	13	6

Thirty-three lectures and one elocutionary entertainment were delivered during the year, attended by an average of 200 persons, costing the committee, for incidental expenses, about £10, all the Lecturers giving their services gratuitously (to whom the thanks of the committee, the members, and the public, are especially due), and thus realizing directly by the sale of lecture tickets, £14 19s. 6d. At the expense of J. W. Gilbart, Esq., F.R.S., a course of lectures was given by Professor Leoni Levi, on " The Principles of Commerce and Commercial Law." The reading-room and library have not cost more than £72, including a sum of £25 paid for books, through the liberality of J. W. Gilbart, Esq., and £10 10s. the annual subscription to Mudie's Library. The rent account stands thus:—

Rent, Rates, and Taxes, for the year 1857—8	£360	0	0
Less received for lettings of Throne Room, &c.	£152	4	0
Deficiency expected from Endowment Fund	£207	16	0

A day school for boys, under the patronage of the Committee, has also been held upon the premises; at first in a class-room, and subsequently in the Throne-room. It is under the immediate care of Mr. Priestman, and promises well; the numbers having been for the first quarter, 34; for the second, 55; and for the third, 70; producing the sum of £65. This has been expended on the master and a few requisites, but it is expected that next year something will also be available for rent. The committee close their report by asking and offering congratulations upon the success which several of the members have achieved, with much honour to themselves. At the Examination held by the Society of Arts highly satisfactory results were attained, the members attaining 6 prizes, and 11 first-class, 7 second-class, and 13 third-class certificates; in consequence of

which the Institution was declared by the Council of the Society of Arts to be entitled to a prize of £15, and, as a Local Board, to a further sum of £10, both of which have been received. Mr. T. R. Howard, one of the most distinguished candidates, was subsequently nominated by the Council of the Society of Arts to compete for a clerkship in H.M. Customs, and having attended a competitive examination before the Civil Service Commissioners, was placed first in the list of 12 candidates, with the additional honour of being reported by the Commissioners to have shown marked proficiency in all the required subjects of examination. At the Oxford Middle Class Examination, Mr. Edward George Clarke, otherwise favourably known in the Institution, and who was the only candidate from Crosby Hall, appeared as the very first name in the A, or English Section, and received his certificate awarding him the title of Associate in Arts. In less public ways other members have won scarcely inferior distinction; and in a department, which some may think of smaller importance, viz., the cricket-field, the members of this Institution hold a proud pre-eminence among their neighbours. Towards the close of the financial year 1857-8, it was resolved to publish weekly a journal of its proceedings, with a lecture in each number, and this has been carried on since the 26th of last June.

After the reading of the report, the meeting was addressed by the Rev. H. Blomfield, who expressed his regret that the Institution was not yet self-supporting, and urged upon those present the importance of endeavouring by every means in their power to increase the number of members.—The Rev. Thos. Hugo called the special attention of the meeting to the importance of assisting the circulation of the "Evening Classes' Journal," recently commenced. His own conviction was, that it was a most important and valuable movement, calculated to bring the Evening Classes into public notice; to produce an interchange of ideas and of information among the members; and to provide both themselves and others with a succession of valuable lectures at a nominal price. —The Chairman, being now ready to distribute the certificates and prizes, called on the Rev. C. Mackenzie, as Honorary Secretary, who said, he saw around him many topics for congratulation, and but one for regret, and this he would first notice. It was simply this, that the meeting was held in London on the 30th of September, a time at which almost all their friends were out of town. The Inauguration Dinner of the Sheriffs unfortunately took place that evening; but for that circumstance, they might have enjoyed the honour of the presidency of the Lord Mayor of London. It was indeed an occasion when the members of the Crosby Hall Institution might be proud to welcome their friends; for the circumstances under which they met were deeply interesting, and the position that they occupied was very flattering. The reputation which the Evening Classes had won at the examinations of 1856 and 1857 was fully maintained in 1858. On both of the former occasions they had carried off the lion's share of the prizes, and now again they occupied the highest place. This was the only institution to the members of which more than three prizes or more than five first-class certificates had been assigned; and this had received six prizes and eleven first-class certificates. This was the only one that carried off twenty-nine certificates. And it was well worth noticing that in addition to £24 given to the young men, the Society had awarded, agreeably to the laws under which the Examination was conducted, the sum of £15 to the Institution; being £5 for each first prize, and £10 to the Local Board, as having sent up the greatest number of first-class prizemen in proportion to the number of candidates. The latter sum would be set apart to meet the expenses of the "Evening Classes' Journal." After some general remarks upon the benefit which accrued to the candidates and to society generally by these examinations, Mr. Mackenzie introduced the several prizemen, one by one, detailing the degrees of distinction that they had obtained on this and former occasions; and the Chairman, with a few kind and earnest words of encouragement to each, handed them their first-class certificates and prizes. Mr. Mackenzie then introduced others who had received certificates, but to whom no pecuniary reward had been accorded; observing that, however agreeable to receive such substantial compliments, the distinction was valuable simply as a distinction, and would be duly prized by the young men present. They were well aware that the civic crown of oak had stimulated the citizens of Rome to earn the approval of their country, and that the ivy and the laurel wreath which rewarded the exertions of the victor at Athens and at Corinth, had ennobled throughout the world those who had received it. With regard to those who had only succeeded in obtaining certificates of competency, he wished to say, in reference to one subject, French, that there might be a reason for the French pupils not having won so much distinction this year as heretofore. The Council had required the knowledge of French history, as well as of the French language; and some of the best scholars, feeling that this was a portion of study to which they had not been introduced, and not willing to incur the imputation of a comparative failure, had declined to appear before the Examiners. Mr. Mackenzie then introduced to the meeting Mr. E. G. Clarke, who was the only one of their members who had presented himself as a candidate before the Oxford Examiners, and who had received the high distinction of being named the very first in class A, or English Literature, together with the title of Associate in Arts. In the present year, having other things in hand, he had not appeared before the Society of Arts, and therefore had not been among the prizemen on this occasion; but the Committee of the Evening Classes wished to testify their satisfaction at his progress. They desired to present him, through the Chairman, with a cheque for £5 5s. They had ordinarily no funds for such a purpose, but an excellent friend, Mr. Gilbart, had indicated that a part of a liberal donation which he gave last year should be appropriated to such a purpose, and the Committee felt there could not be a better use of it. After the Chairman had presented it, Mr. Clarke returned thanks, and expressed his conviction that no man could stand for a few moments on that platform to receive the words of approbation from the Chairman, without resolving still to pursue distinction, and to strive better to deserve the approbation of his friends and neighbours. He then warmly advocated the cause of the "Evening Classes Journal," and asked leave to propose a vote of thanks to the Local Board, who had conducted the preliminary examination, which having been seconded by Mr. Machell, was unanimously carried.—The Rev. R. Whittington being called on to reply, said, that he placed the greatest value on the preliminary examinations, which it was the duty of the local board to institute; and that he attributed the marked success which their members had obtained, to the honest way in which these examinations had been conducted.—The Rev. F. G. Blomfield desired to express their obligations to the Committee of Management, and especially alluded to the exertions of his friend, Mr. Mackenzie, who had for so many years given so much time, and care, and labour to this work. Accordingly, in terms of high eulogium, he proposed a vote of thanks to the Committee of Management and the Honorary Secretary.—This was acknowledged by Mr. Mackenzie, who spoke in high terms of the valuable assistance he had received from Mr. Whittington and the Committee, and concluded by proposing a vote of thanks to the Chairman and the Council of the Society of Arts.—In acknowledging the vote of thanks, Mr. Winkworth said he would first avail himself of the occasion to assure Mr. Mackenzie that he would not fail to represent to the examiners through the council, the wish of the committee of management to have the conditions of the French examinations revised and the reasons for it. He would next express his entire satisfaction with the business of the evening, which afforded him a treat he

had not expected when he entered the room. The proud position which that institution occupied in the recent Society of Arts Examinations, was due partly to the superintendence of the committee and secretary, but principally to that spirit of inquiry which actuated all the classes. He sincerely congratulated the successful candidates, as the accidental organ of the council, on the success they had achieved, and earnestly entreated them to pursue, if possible, with increased ardour, the honourable path on which they had entered. Education was the work of a life if the motto "It is never too late to learn" was literally true. New discoveries in Art and Science were continually being made, and their rapidity and importance it was difficult to conceive or over estimate. We must not only keep ourselves *au courant* with them, but should assist in their development. He concluded the business of the meeting by thanking the audience for the indulgent attention they had lent to his efforts to discharge the duties which so unexpectedly devolved upon him.—This was duly seconded and carried unanimously. The formal notices of the next week's business were read, and the meeting separated.

Nailsworth (Literary and Mechanics' Institute).—The annual general meeting of this Institution was held on Tuesday evening, September 7th, at the Nailsworth Subscription Rooms. In the absence of the president, the chair was taken by Mr. E. Barnard, vice-president. The secretary, Mr. A. Leonard, read the report of the past year's proceedings, which speaks of a steady increase in the number of subscribers, a good attendance at the society's lectures and discussions, and an increased circulation of books, all of which show that the objects of the Institution are thoroughly understood and appreciated. The present number of members is 161, who are divided into thirty 20s., forty-two 10s., and eighty-nine 4s. subscribers, being an increase of 26 members upon the last year's subscribers. The financial prospect of the society is satisfactory. After defraying all the expenses of the year, a balance remains in the hands of the treasurer. The library has received a small addition during the past year, but the ample supply already at the disposal of the members, has met their requirements, and a fresh class of books can only be obtained by some special effort for that purpose, as the more general funds of the society are not sufficient to meet any unusual demand. The usual course of lectures has been well attended, those that have been gratuitously delivered being especially popular. The good attendance at the discussions has satisfied the committee that this branch of the society is still approved by the members. The committee finding that the formation of classes for mutual and other instruction is much needed, and having no rooms at their disposal in which such classes could meet; and having also long felt the need of a committee-room and anteroom for the accommodation of lecturers, &c., have proposed to fit up the unoccupied portion of the subscription-rooms as class and committee-rooms, and are obtaining subscriptions for this purpose. It is thought that these rooms would also be useful in accommodating a Sick Benefit Society and Penny Bank, and might also serve as a Museum of objects of local interest. From the financial statement it appears that the receipts have been about £98, and the disbursements about £95. The officers and committee for the ensuing year were then elected, and arrangements made for commencing the new session. After a vote of thanks to the chairman, the meeting separated.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 8, 1858.]

Dated 12th July, 1858.

1561. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An apparatus for stopping leaks in ships. (A com.)

Dated 21st September, 1858.

2117. T. Cook, Addiscombe, Surrey—Imp. in the method of preparing and securing bankers' and other crossed cheques against fraudulent erasure or removal.
2119. L. De Pariente, Paris—Imp. in apparatus to be applied to gas burners, with the object of increasing the lighting power of the gas flame. (A com.)
2121. John Bethell, 8, Parliament-street, Westminster—Imp. in treating pyrites.
2123. J. Dewrance, Barge-yard, London—An imp. in the construction of pianoforte frames.

Dated 22nd September, 1858.

2125. J. Johnson, Manchester—Imp. in machinery or apparatus for washing, churning, colour-mixing, or similar purposes.
2127. J. Hope, Rhode Island, U.S.—An improved calico printing roller.
2129. T. Howe, Millwall, Poplar—Imp. in smiths' forges.
2131. J. Tyssen, Rotterdam, Holland—An improved apparatus for indicating the speed of ships and other vessels.
2133. L. Castelain, 53, Newman-street, Oxford-street—Converting all vegetable fibre, by aid of chemicals, into form to resemble horsehair.
2135. A. B. Childs, Gower-street, Middlesex—Imp. in winnowing machinery.

Dated 23rd September, 1858.

2137. A. F. Jaloureau, Paris—Imp. in the manufacture of pipes.
2139. T. C. Hinde, Dudley, Worcestershire—An imp. or imps. in the manufacture of iron and steel.
2141. J. Wilson, 55, John-street, Sunderland—Imp. in floating docks.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Oct.* 8, 1858.]

October 5th.

763. W. Ager.
778. F. A. Lecornu.
782. W. Rowett.
783. A. Manbré.
787. S. Bickerton.
789. T. Kay.
791. P. Ratel.
795. T. T. Jopling.
797. P. Schafer and F. Schafer.
812. J. Knight.
822. A. H. A. Durant.
826. G. G. Brown.
840. W. Carron.
866. J. B. Smith.
867. D. Moore.
907. R. Bodmer.
935. M. Sautter.
1026. W. E. Newton.
1035. W. E. Newton.
1122. J. Hesford.
1196. C. Clarke.
1590. J. Rheinauer.
1623. C. Reeves.
1634. T. Bailey.
1754. W. Taylor.
1856. M. A. F. Mennons.

[*From Gazette, Oct.* 12, 1858.]

October 12th.

732. C. H. Chadburn.
802. G. Pye, R. Smith, and B. Croasdale.
803. W. C. Holmes and W. Hollinshead.
806. J. Gorham.
808. J. Gray.
810. E. Green.
817. L. Cowell.
827. G. Walker.
829. A. P. Price.
834. J. Grassay.
836. F. C. Gilbert.
837. D. Chalmers and J. T. Swallow.
839. J. R. Chirm.
846. T. Luck.
915. J. Braidwood.
1425. P. Griffiths.
1570. J. A. Fussell.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Oct.* 8, 1858.]

October 4th.

2224. P. A. Halkett.

October 6th.

2243. W. Rothera.

[*From Gazette, Oct.* 12, 1858.]

October 7th.

2245. J. H. Johnson.

October 8th.

2267. J. Thornton, A. Thornton, W. Thornton, and H. Thornton.

October 9th.

2309. W. Cotton.
2354. T. Valentine, D. Foster, and G. Haworth.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address
4120	Sept. 22.	The Eureka Buckle	C. Rowley and Co.	Newhall-street, Birmingham.
4121	Oct. 7.	The Hercules Shirt, without gathers	J. Bremner	13, Eldon-street, Kensington.
4122	„ 9.	The Uniform Front	T. R. Barlow	143, Tooley-street, Southwark.

Journal of the Society of Arts.

FRIDAY, OCTOBER 22, 1858.

EXAMINATIONS, 1859.

In reply to inquiries by correspondents, in reference to the Examination in French next year, the following works have been mentioned by the Examiner in that subject, as likely to be useful to candidates in studying the history of France :—

Duruy's Histoire de France. 2 vols, 6s. 6d.
Soulain de Bossay's Histoire de France. 1 vol., 1s.

The following editions of works which may be taken up by candidates are given, as being moderate in price and easily procured :—

Voltaire: Louis XIV. (Firmin Didot). 2s. 6d.
Montesquieu: Grandeur et Décadence des Romains. (Ditto). 2s. 6d.
Les Œuvres de Corneille. 2 vols., 5s.
Tocqueville: L'Ancien Régime et la Revolution. 6s. 6d.

These may be obtained of Messrs. Williams and Norgate, Henrietta-street, Covent-garden.

BRITISH ASSOCIATION, LEEDS, 1858.

The Patent Laws.

Report of the Committee of the British Association, presented to the Mechanical Section by W. Fairbairn, F.R.S., President:—

The subject of the patent laws has frequently occupied the attention of meetings of the British Association, and committees have been, from time to time, appointed for the purpose of considering how those laws might be rendered more efficient for the objects with which they are maintained. Your Vice-President, the Rev. Vernon Harcourt, in the inaugural address at the first meeting of the Association, held at York, September, 1831, in which he expounded the objects and plan of the Association, referred to those laws as an instance in which fiscal regulations interfered with the progress of practical science, and as failing to give protection to property in scientific invention, to the same extent as protection is given to every other species of property, and he suggested a revision of those laws as one of the subjects to which a scientific association might be justly expected to call public attention, and your Vice-President, Sir David Brewster, and others, have, on several occasions, brought the subject before meetings of the Association.

By the Patent Law Amendment Act, passed in the session of 1852, the rights of the inventor to property in the offspring of his brain, and in the creations of his intellect, when embodied in products of national industry, were fully recognised; provisional protection to that property was secured to such inventor, from the date of his application for a patent; one proceeding was substituted, and one patent issued, extending to the whole of the United Kingdom, instead of three proceedings and three patents, separate and distinct, for each of the three countries, England, Scotland, and Ireland; property was created, and protection obtained for six months by a payment of £5, for three years by a payment of £25, and for the further terms of four and seven years by additional payments of £50 and £100 respectively, instead of by the payment of upwards of £300 in the first instance, under circumstances of such uncertainty as threw discredit on the whole system; the specifications of all patents are to be printed and published, and sold at extremely low prices, a benefit to the public as well as the inventor which it would be difficult to estimate too highly; and, lastly, provision was made for the regulation of matters relating to patents, by Commissioners furnished with ample powers for the purpose.

This Act came into operation on the 1st of October, 1852, and the experience of the first two years showed that the payments by inventors, upon the above scale of charges, would be at the rate of more than £50,000 per annum, without including the further or additional payments for the maintenance of the patents for the further terms of four or seven years, after the expiration of the first three or seven years respectively. At the meeting of the British Association in Liverpool, September, 1854, a committee, presided over by the Earl of Harrowby, was appointed "for the purpose of taking such steps as may be necessary to render the patent system, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors, and the advancement of practical science." This committee communicated with Earl Granville and Lord Brougham, to whose exertions and watchful care the passage of the measure of 1852 was attributable, and made a report to the meeting of the British Association held in Glasgow in the following year, when the subject of the tax on inventors, and the appropriation of the funds so levied, was fully discussed; and another committee, consisting of his Grace the Duke of Argyll, the Earl of Harrowby, Colonel Sabine, the Master of the Mint (Professor Graham), Mr. Fairbairn, and Mr. Webster, were appointed with similar powers. The Glasgow Committee addressed a memorial to the Lord Chancellor (Lord Cranworth), calling attention to the proceedings which had taken place at the various meetings of the British Association; to the numerous questions of administration and legislation then adverted to, or which might be expected to arise; and suggesting that her Majesty should be advised, in accordance with the provisions of the Patent Law Amendment Act, 1852, to appoint others than the official Commissioners, and to make the working of that Act the subject of immediate inquiry.

At the meeting of the British Association held at Cheltenham in 1856, a committee, consisting of the Earl of Harrowby, Lord Stanley, M.P., Mr. Fairbairn, Professor Graham (the Master of the Mint), Mr. James Heywood, Mr. Commissioner Hill, Gen. Sabine, and Mr. Webster, were appointed with like powers. The Earl of Harrowby and Mr. James Heywood communicated personally with the Lord Chancellor; Lord Stanley took a warm interest in the subject, embodying his views on the necessary alterations in a published pamphlet, but up to this time the objects in view have not been attained, and it will be for this meeting of the British Association to consider what further steps should be taken.

The printing and publication of the specifications has led to results which were hardly anticipated, as to which the following extract, from a report of the Commissioners of Patents in 1856, will be read with interest:—

"The Commissioners of Patents have presented complete copies of all their publications to such of the Government offices and seats of learning as have applied for them, and to the principal towns in the United Kingdom, on condition of their being daily open to the inspection of the public free of charge. In their selection of towns for this gift, they have been guided by the number of applications for patents proceeding from each.

"This gift has in most cases laid the foundation of public free libraries where none previously existed. In some instances, where the local authorities hesitated to accept the works on account of the incidental expenses, the custody has been solicited and temporarily under-

taken by scientific institutions, which have modified their bye-laws to enable a free admission to the public daily to the library in which the works are deposited."

The same report, after enumerating a list of the places which have received the works, says:—"It is satisfactory to find that these national records of invention are especially consulted by that class whose skill in the improvement of manufactures is so essential to the maintenance of the commercial prosperity of this kingdom," and adds the testimony of the librarians of several of the free libraries to the same effect.

Complete sets of the Commissioners' works have been sent to the Colonies, to many foreign States, to the Patent Office, Washington, to the Aster Library, New York, to the Franklin Institution of Pennsylvania, to the Public Free Library, Boston, U.S.; and the Hon. Charles Mason, Commissioner of Patents for the United States, addressing the Commissioners of Patents in this country, writes as follows:—

"The admirable example you have set in publishing the specifications and drawings in full, and putting them on sale at a moderate price, so that all can easily provide themselves with what they need for private use, will ere long I trust stimulate our own Government to do the like. Nothing short of this in the way of publication can give permanent satisfaction."

A free library and reading-room has been opened at the Office of the Commissioners of Patents, containing a large collection of works of reference, which, as the same report states, is numerously attended by professional men, the agents of foreign and provincial inventors, and by practical mechanics and operatives; and Mr. Woodcroft has collected a large number of portraits of inventors, and of models illustrative of the history and progress of invention, which it may be hoped at a no distant period will form a principal object in a National Gallery of Inventions and Museum of Inventions.

These and other undertakings, well suited to promote the advance of practical science and the interest of inventors, afford legitimate objects for the expenditure of the surplus funds levied on inventors, but when ample provision shall have been made for these objects there will still be a considerable annual surplus.

The amount paid by patentees during the last year was upwards of £83,000, and after the commencement of the payment of £100 at the expiration of the seventh year, the amount levied on inventors will not be less than £100,000 per annum, a sum which as levied on inventors and inventions, may reasonably be expected to be expended on objects in which inventors have some interest.

In reference to this branch of the subject the following questions would appear to arise for consideration:—

1. Should the present scale of payment be maintained or reduced, so as to leave no great surplus beyond what may be necessary for the official expenses?
2. If the present scale be maintained, how should the surplus be appropriated?

It appears that the second payment of £50 before the end of the third year is not made in respect of more than about one-fourth of the whole number of patents issued, that payment being made on about 500 out of 2,000 patents, so that 1,500 are permitted to lapse, the cost of which in money to the patentees cannot be taken at less than £75,000, in addition to the expenditure of time and labour on the respective inventions. Can anything be done to diminish this loss, beyond affording every facility for access to information as to what has been done before, and the improved education of the people?

In addition to these considerations and suggestions in connection with the new system as recently established, and which are of the fiscal character referred to by your Vice-President, there are some other questions deeply affecting the interests of inventors and the advancement of practical science, which it would not be proper to close this report without adverting to.

The Patent Law Reform of 1852 was never regarded as a final measure. It was but a first instalment, obtained under great difficulty; it only laid the foundation of the superstructure yet to be raised. The following important questions of—1. Improved protection to the property so created; 2. The amendment of existing patents and specifications, so as to save what is really new and useful, according to the amendment of the Patent Law, as effected by Lord Brougham in 1835; 3. The confirmation of an invention re-invented and introduced into successful use according to the principle of the confirmation of rights effected by the same noble lord; 4. The extension of the term of patents which have not yielded adequate remuneration to the inventor; 5. Reward to a meritorious inventor, who, from causes wholly beyond his control, has been a great loser by, or derived no benefit from, a meritorious invention, from which the public have derived great benefit; 6. A system of compulsory licenses under existing patents; are questions all of which were omitted advisedly by the promoters of the recent measure, their attention being directed mainly to the destruction of the existing, and the establishment of a new system of creating property in inventions.

These, with other amendments and matters of minor importance, which the experience of six years of the working of the new system have disclosed, will involve further legislation, and the consolidation and repeal of no less than 16 statutes or parts of statutes, an object of great importance to every inventor.

Your committee now remit this subject to the consideration of the meeting of the British Association, deriving confidence from the belief that the times are not unfavourable for further action, and that the town and neighbourhood in which the Association is now assembled may appropriately claim to take a prominent part in the consummation of those reforms which have occupied the attention of so many meetings of the British Association.

Leeds, Sept. 22, 1858.

On the Annual Yield of Nitrogen per Acre in Different Crops.

The following is an abstract of a paper read before Section B., by J. B. Lawes, F.R.S., F.C.S., and J. H. Gilbert, Ph.D., F.C.S.:—

In a paper given last year at the Dublin Meeting, on the question of the Assimilation of Free Nitrogen by Plants, and some allied points, the authors had stated, in general terms, that the amount of nitrogen yielded per acre per annum in different crops—even when unmanured—was considerably beyond that annually coming down, in the forms of ammonia and nitric acid, in the yet measured and analysed aqueous deposits from the atmosphere. The investigations then referred to were still in progress, and a desirable introduction to the record of the results would obviously be to illustrate, by reference to direct experiment, that which had been before only assumed, regarding the yield of nitrogen in our different crops. To this end had been determined the annual produce of nitrogen per acre, in the case of various crops, which were respectively grown for many years consecutively on the same land, namely, wheat, 14 years, barley, 6 years, meadow hay, 3 years, clover, 3 years out of 4, beans 11 years, and turnips 8 years. In the majority of the instances referred to, the yield of nitrogen had been estimated, both for the crop grown without manure of any kind, and for that with purely mineral manure—that is, excluding any artificial supply of nitrogen. It was the object of the present communication to give a summary view of some of the facts thus brought to light.

Beans and clover were shown to yield several times as much nitrogen per acre as wheat or barley. Yet the growth of the leguminous crops, carrying off so much nitrogen as they did, was still one of the best preparations

for the growth of wheat; whilst fallow (an important effect of which was the accumulation within the soil of the available nitrogen of two years into one) and adding nitrogenous manures, had each much the same effect in increasing the produce of the cereal crops.

Other experimental results were adduced, which illustrated the fact that 4 years of wheat alternated with fallow had given as much nitrogen in the 8 years as 8 crops of wheat grown consecutively. Again, 4 crops of wheat, grown in alternation with beans, had given nearly the same amount of nitrogen per acre as the 4 crops grown in alternation with fallow, consequently, also, much about the same as the 8 crops of wheat grown consecutively. In the case of the alternation with beans, therefore, the whole of the nitrogen obtained in the beans themselves was over and above that which was obtained during the same series of years in wheat alone, whether it was grown consecutively or in alternation with fallow.

Interesting questions arose, therefore, as to the varying sources or powers of accumulation of nitrogen in the case of crops so characteristically differing from one another as those above referred to.

It had been found that the leguminous crops, which yielded in their produce such a comparatively large amount of nitrogen over a given area of land, were not specially benefited by the direct application of the more purely nitrogenous manures. The cereal crops, on the other hand, whose acreage yield of nitrogen under equal circumstances was comparatively so small, were very much increased by the use of direct nitrogenous manures. But it was found that, over a series of years, only about four-tenths of the nitrogen annually supplied in manure for wheat or barley (in the form of ammonia-salts or nitrates), were recovered in the immediate increase of crop. Was any considerable proportion of the unrecovered amount drained away and lost? Was the supplied nitrogenous compound transformed in the soil, and nitrogen in some form evaporated? Did a portion remain in some fixed and unavailable state of combination in the soil? Was ammonia or free nitrogen given off during the growth of the plant? Or, how far was there an unfavourable distribution and state of combination within the soil of the nitrogenous matters applied directly for the cereal crops—those, such as the leguminous crops, which assimilated so much more, gathering with greater facility, and from a different area of soil, and leaving a sufficient available nitrogenous residue within the range of collection of a succeeding cereal crop? These questions, among others which their solution more or less involved, required further elucidation before some of the most prominent of agricultural facts could be satisfactorily explained.

Comparing the amount of nitrogen yielded in the different crops when grown without nitrogenous manure, as above referred to, with the amount falling in the measured aqueous deposits, as ammonia and nitric acid, it appeared, taking the average results of the analysis of three years' rain, that all the crops yielded considerably more, and some very much more, than so came down to the soil. The same was the case when several of the crops had been grown in an ordinary rotation with one another, but without manure, through two or three successive courses. Was this observed excess in the yield over the yet measured sources at all materially due merely to exhaustion of previously accumulated nitrogenous compound within the soil? Was it probably attributable chiefly to the absorption of ammonia or nitric acid from the air by the plant itself or by the soil? Was there any notable formation of ammonia or nitric acid from the free nitrogen of the atmosphere? Or did plants generally, or some in particular, assimilate this free nitrogen?

As already intimated, some of the points which had been alluded to were, at the present time, under investigation, the authors having in this the able assistance of Dr. Pugh. Others, it might be hoped, would receive elucidation in the course of time. There of course still remained the wider questions of the original source, and of the distribution and circulation of combined nitrogen in the soil, in animal and vegetable life on the earth's surface, and in the atmosphere above it?

PATENT MUSEUM, SOUTH KENSINGTON.

The following is the number of visitors for the week ending 16th October, 1858:—Morning, 695; Evening, 759. Total, 1,454. Total number of visitors to the Patent Museum and Library since the period of free daily admission,—31,814.

Colonial Correspondence.

LABOUR IN THE WEST INDIES.

Sir.—That *vexata quæstio*, labour in our West India colonies, appears to be still as far from a satisfactory settlement as when, twenty years ago, it began to stir up the angry feelings of the growers of sugar and the manufacturers of rum. To the abolition of slavery and the adoption of free trade, the depressed condition of those colonies has been ascribed. Those events, when they first occurred, did, no doubt, occasion a violent shock to them. The annihilation of slavery and protection did unquestionably, for a time, exercise upon them a precipitating influence. But the effect may be compared to one of their own hurricanes. Houses are blown down, trees are prostrated, roads are torn up, and the roaring tide, lashed into fury by the wind, marches like a conqueror over the land, laying waste "trim gardens," and sweeping away temples, and obelisks, fountains, and grottoes; but when the gale subsides, the heavens are serene and bright, and the air, cleared of noxious vapours and the floating seeds of disease, is sweet and fresh; the wild rabbit again peeps from her hole, the birds venture from their leafy hiding-places, and again sing their matin songs and chant their vesper lays, and all nature, awakened as it were from a disturbed dream, is placid and at rest. Such was the convulsion produced at first by emancipation and free trade. The effects were natural, and to be expected. The colonies were struck to the earth; but, like Antæus, they ought to have arisen with renewed strength. If they did not do so it was their own fault. Protection has gone, but with it has gone an abnormal condition of trade, in which the prices of commodities were regulated by restrictive laws, instead of being governed by the natural rise and fall of the markets. Slavery has gone, but with it have gone much cruelty, much depravity, and a system of labour in which the only tie between the master and his servant was the chain, the only incentive to work was the cat. But instead of protection, we have trade freed from restraints, and, like an infant Hercules liberated from ligatures and bandages, beginning to exhibit its extraordinary powers. In place of slavery we have free labour;—the work of willing hands and cheerful hearts, instead of the constrained toil of reluctant limbs and broken spirits.

As early as the year 1514, the repugnance of slavery to natural rights, was acknowledged and pronounced by no less a person than Henry VIII. That monarch emancipated two of his slaves with their families, and the deed of manumission commences as follows:—

"God at first created all men equally free by nature, but many have been reduced to slavery by the laws of men. We believe it, therefore, to be a pious act, and meritorious in the sight of God, to set certain of our slaves at liberty from their bondage, &c."

It is not easy to account for such language, coming from a man who has been justly described as—

"The monster king of all that age,
Fierce in his lust, but fiercer in his rage.'

The words "natural rights" sound ridiculous when proceeding from the mouth of the ruthless tyrant who slaughtered Surrey, murdered Moore, and divorced himself *à vinculo* from his wives by a *bill* sharp and sudden, and much more effective than the parliamentary one which has recently come into operation for dissolving the marriage tie.

That free labour was much better than slave labour, that it was more economical and more productive, that it was more satisfactory in every sense, both to the master and to the servant, was discovered in the 14th century. Henry says: "Various causes contributed to the decline of villenage in England. The proprietors of land by degrees discovered that slaves, who laboured not for themselves, but for their masters, were often indolent or refractory, and that they got their work performed better, and even at less expense, by hired servants."

What was true in the fourteenth century is true in the nineteenth. What was true in England is true in Jamaica, in the United States, and in Cuba. But, in the two latter countries, they cannot or will not perceive it. Nay, even in our own colonies, there are many who look back to the days of slavery with regret—as the Israelites in the desert lamented the time when they were in the land of Egypt, when they sat by the flesh-pots, and when they did eat bread to the full, as they languished in the arid and pathless wild, for the savoury messes and the barley-wine on which they feasted in the days of their bondage. Many there are who look enviously at Cuba, and wish that they also could have slaves to cultivate their sugar plantations and their coffee mountains. Many there are who, if they dared, would call loudly for a return to the vicious system of "involuntary servitude." Of course all would repel with indignation such a horrid imputation. Nevertheless, there are individuals who indulge in such an iniquitous wish, but it is concealed in the darkest recesses of their hearts—in some mental "chamber of horrors," the contents of which will never be known to the world, unless during a fit of drunkenness or insanity the owner should involuntarily leave the door open—as Falkland locked up the bloody dagger, the evidence of his guilt, in his impenetrable iron chest. It is fortunate that in their case there is no prying Caleb Williams, to drag to light the "shape unholy." Although it is quite impossible to sympathise with those who indulge in such wicked longings, so far as those longings are concerned, it is also, at the same time, impossible to deny that they have abundant cause for discontent. When they see the verdant slopes and rich valleys of Cuba, covered with the bright green blade of the sugar-cane, or the beautiful white blossom of the coffee-tree; when they see the lofty Moro castle, and the battery of La Punta, which protect the capacious harbour of Havana, crowded with stately vessels from all parts of the world—from Glasgow, Liverpool, and London, from New York, Boston, and New Orleans, from St. Petersburgh, Havre, and Hamburgh; when they see the streets of that opulent and magnificent city thronged with busy and anxious passengers, hastening to keep appointments for the sale or purchase of valuable cargoes of sugar, coffee, or tobacco; when they see the long *passeos*, with their palaces, statues, and hedges of rose-trees, crowded with volantes mounted with solid silver, and drawn by large black Spanish mules, decorated with the most costly trappings, rolling rapidly along; when they see the Plaza de Armas brilliantly lighted with gas, where a large assemblage of richly-attired and beautiful ladies, wearing a light gauze mantilla, which is thrown over their dark glossy hair, and which floats behind them like a thin silvery cloud, promenade with their husbands, brothers, and caballeros, and listen to the splendid military band which is playing the newest polkas and waltzes before the Captain-General's palace, a large Italian structure, adorned with pilasters having Corinthian capitals, the open windows of which exhibit a scene within gorgeous with wax-lights, gold and silver plate, silks, and jewels; when they observe all these indications of wealth and prosperity, and they turn to to their own melancholy island, and behold brown, parched plains, or tangled wildernesses of bush and briar, the abodes of the agouta and the lizard, where, instead of the lowing of oxen, the creaking of wheels, and the whetting of scythes, they hear the chirp of the squirrel and the coo of the wood-pigeon; when they see a town, once rich and flourishing, now looking like a city which has been beleaguered, sacked, and pillaged; instead of noble Grecian structures, having porticoes of Doric or Ionic columns, with lions beautifully executed in the whitest marble frowning at the entrance, they see rotten wooden buildings, leaning on one side like the tower at Pisa, with every gust of wind a shingle flying from the roof, with every shower of rain a torrent rushing through the doors; instead of the gay volantes lustrous with burnished silver, and paint, and varnish, and driven by a smart servant, having on a red or blue jacket covered with gold lace, and polished jack-boots rivalling his skin in brilliancy and blackness, they see a wretched vehicle, which looks like the skeleton of a young omnibus—like a starved stage-coach not arrived at its majority, the lining greasy, torn, and moth-eaten, the paint almost entirely scrubbed off, broken springs mended with old rope, and pulled through the sand fetlock deep, sometimes by two horses, which appear to have been the subjects of the experimental philosopher, and to have arrived at an oat a-day, flavoured perhaps with a single blade of grass, sometimes by a tall horse and little pony, and sometimes by a mule and a donkey, and urged on by every persuasion of voice and whip which the black, grinning, shoeless, hatless, coatless, saucy driver can have recourse to; instead of the granite paved streets and macadamised *passeos*, abominable ways in which there is every kind of nuisance and dangerous obstruction, here a heap of old bricks, and tiles, and broken bottles, there a dunghill, here a huge fissure, and there a deep pit attempted to be filled up with straw and manure, abounding with dangers as great as the Maelstrom, Scylla and Charybdis, and those dreaded rocks of Epirus, called by Horace—

"Infames scopulos Acroceraunia;"

when the colonists behold this contrast, they may be excused for complaining, and although their complaints are not always just and reasonable, still they may be pardoned.

The question however, is, what is to be done? It cannot be supposed that the British Government or the British people are indifferent to their distress, although they may not think, that for the purpose of relieving them, a decree should go out that all the world should be taxed. It seems that "labour" is the cry. Give us, say they, an unrestricted permission to engage free negroes on the coast of Africa, until we shall be able to compete with the slave-cultivated colonies. But permission to hire free negroes on the coast of Africa never will be accorded them; it is useless therefore to go on crying for what they cannot have, like little Pickle in the "Spoiled Child," who howled because he was not permitted to sit a-stride of the roasted saddle of mutton; or like the dear, sweet child, who set up his shrill pipes and deafened the whole neighbourhood, because he could'nt have the moon to play with—little innocent!

In my opinion, the danger of all unlimited engagement of free negro labour in Africa, has been greatly exaggerated by the fears of those philanthropic men by whose noble efforts the "damned spot" of slavery was obliterated throughout the whole length and breadth of the British Empire. A license to engage free negroes for our colonies, would, no doubt, be liable to be abused, but securities might be devised which would have the effect of preventing any illicit traffic from being carried on. A license, subject to certain restrictions, to hire African labourers, would, I conceive, be more likely to

check the slave trade, and ultimately to extinguish that abominable traffic altogether, than the means which are at present adopted. To suppose that we can prevent slaves from being landed in Cuba by sending our ships of war to cruise along the coast of that island, is simply absurd. A "cruiser's digest" would show how fruitless has been the scheme. Cuba has at least 2,000 miles of coast, and the combined fleets of England and France would not be able effectually to blockade it. A thousand "Leviathans" could not do it. General Cass, in a letter to Lord Napier, says, "the joint blockade of the coast of Africa has been pursued some years, and the benefit it has produced bears no reasonable proportion, he regrets to observe, to the expenditure of life and treasure it has cost." This is no doubt quite true, but the writer adds, "but there is another way, without the danger and difficulties and inefficiency, and that is to shut the ports of Cuba. But supposing we could be justified in having recourse to such a proceeding (amounting in fact to a declaration of war) towards a nation with which we are at peace, how would it prevent the landing of slaves? Does the captain of a smuggler ever attempt to come into a port until he has discharged his cargo? Would our friend Nanty Ewart of the "Jumping Jenny" have done such a thing? No; he would not have been guilty of such an act of stupidity; he knew his business too well. A smuggler who knows his trade, and who is cool and cautious, and not like that pig-headed ruffian Dirk Hatteraick, will stand off and on until he has the signal which informs him that "All's right," when he will run his craft into a snug, secluded little bay, and, at the dead of night, when all is prepared—when the light covered carts, with wheels wrapped round with straw and other ingenious contrivances, are in readiness—will land his cargo in safety. Robin Hood's Bay, near Scarborough, and Skinnengrave, a small village on the sea coast, near Skelton Castle, once the seat of the De Bruses, were, 30 years ago, the scenes of many a romantic smuggling adventure.

Mr. Cass seems to think that a slaver goes boldly into the harbour of Havana, in St. Iago de Cuba. No such thing. She dodges about during the day, and steals quietly under the cloud of night into one of those numerous bights which abound on the coast of Cuba, where there is not a single human habitation, and where the slaves may be landed without the slighest chance of detection. The instant the poor creatures have placed their feet upon the shore, they are whisked away in every direction, with as much celerity as the dishes which were swept from the longing eyes of the hungry Sancho, when that practical philosopher was giving proof that a man may make a good governor without having been brought up to the craft, and that no special qualifications, beyond sound common sense and shrewd mother wit, were requisite for the office. Some years ago, whilst sailing into the Havana, the pilot drew our attention to a small, black, wicked-looking schooner, clipper-built, and having her masts well raked, which was lying at anchor about fifty yards from the Moro Castle. He informed us that she had landed 500 slaves at a little bight about ten miles off, and early that morning she had come into the harbour with all the appearance of an honest mercantile vessel, having all the necessary papers strictly correct. I do not recollect under what flag she sailed. An English and an American war-steamer had been cruising about at the time, and these vessels were now lying close together, appearing to be on the most amicable terms.

Mr. Mason, the American Minister to France, in a letter to the President, says, "he feels confident that in future the denunciation of American slavery will be greatly moderated, if not silenced in France, perhaps in England." He adds, "that it is quite evident that the conviction is gaining strength, both in England and France, that the compulsory emancipation of the slaves in their tropical colonies, by authority of their governments, was a grave political error."

In England, those who are able to think calmly, dispassionately, and rationally upon the subject of American slavery, are of opinion that it ought to be abolished as soon as possible, but that to give so great a number of slaves as exist in the Southern States of the Union, the greater portion of whom are without any mental culture, immediate emancipation, would be a dangerous experiment. But there is not in England a single individual deserving of respect, who regrets in the slightest degree the sudden and complete emancipation of the slaves in our own colonies. The people of England—who, with all their faults, and they have many, have a strong natural hatred of oppression in every form—do not think that it was a grave political error. They rejoice that it was done, although it was an expensive operation; although great violence was done to that vestiary department which an Englishman guards as vigilantly as did the dragons the golden apples of the Hesperides—*videlicet*, his breeches pocket. They do not grudge one farthing of the money which accomplished so glorious an object. Nay, it is my firm belief, that, careful, cautious, and unenthusiastic as they are, and, in some cases, frugal to a fault, they would, in the interests of humanity, gladly pay the same amount again to put an end to slavery in every part of the world. The very name of slavery is odious to every Englishman. It grates upon his ear. If it were in his power he would annihilate the thing, and abolish the word. Not a dictionary should contain it, and it should be an offence punishable by fine and imprisonment to utter it. But the slaveholders of the States will say to him, "Why do you kick up such a shindy about our niggers, when you have no end of slaves in your own country? Look at that little factory boy with his precocious pensiveness and his premature sadness. He is scarcely 10 years old, and yet he has the thoughtful expression of a man of 30, and already—like Peter Bell—his 'forehead wrinkled is, and furred by thinking of his *whens* and *hows*.' Look at the father of that poor child of want and misery. He is 35 years of age; but, judging from his appearance, you would say that he was 60. His hair is white, his countenance cadaverous, his shoulders round, his back bent, and his legs crooked. Look at that young girl, with her delicately chiselled features, her large expressive blue eyes, and her faultless form. If her parents had been wealthy, if they had been amongst the aristocracy of the land, hundreds would have knelt at her feet, and done fealty to her charms. But they belong not to that caste, and she is only a poor seamstress, with a widowed, bedridden mother and two young sisters to support. Alas! they will not have her support long, for her cheek is pale and thin, and hollow; her eye has an unnatural burning lustre, and ever and anon she coughs a short dry cough, and as she does so, she puts her long transparent hand upon her side. Why does she do so? Ah! postpone your inquiry for three months, then make it, and read the answer engraved upon a small piece of freestone standing in the ground amongst a number of little grassy hillocks—the unpretending tumuli of the poor. Well, are not these, and hundreds more whom I could mention, slaves—aye, as much slaves as our negroes. The only difference is, *our* slaves have comfortable homes and plenty to eat and drink, *your* slaves die of hunger, cold, and wretchedness."

Americans may talk, and have talked in this strain. But the cases are not parallel. It is true that we have much, too much, wretchedness and want,—it is true that there are heartless masters and mistresses who grind those whom they employ down to the earth. But the poor creatures who are thus treated still are FREE. They may leave their task-masters and task-mistresses whenever they like, and they are paid for their labour, although that pay is sometimes, indeed, very, very small. Though born to an unhappy lot, they are *not* slaves. They cannot be bought and sold; they cannot be made the victims of an employer's brutal passions; they cannot have the brands of ownership burnt

into their flesh; they cannot have their ears cut off or their eyes gouged; they cannot be separated from their offspring; the greatest and wealthiest in the land cannot wrong them with impunity. Above all, they cannot be prevented from reading their Bible, that well-spring of hope, that everlasting fountain of comfort and consolation.

To return to African free labour. I have said that the danger of permitting free negroes to be engaged on the coast of Africa has been greatly magnified. But the opinion and feeling of a large and respectable class are too strong against that permission. We may take it, then, as a thing settled and decided, that the British Government never will, at least not for many years, give their sanction to it. But let us seriously inquire what we lose by the prohibition. We must have labour for our colonies; that is granted. But does it follow that that labour must be African labour? The colonists have been so long accustomed to negro labour, that they think sugar would not be sweet, nor rum well flavoured, without it. When the representatives of all the trades met in solemn conclave to consider what were the best materials with which to fortify their town, which was threatened with a siege, the tanner exclaimed, with honest enthusiasm, and a confiding faith in hides,—"There's nothing like leather." So the West India planter, when you talk to him about labour, ejaculates, with equal fervour, "There's nothing like niggers." The owner of a West India sugar estate, who was a great lover of cheroots and "old Jamaica," and to whom his agent used annually to send a puncheon of the spirit of cane (no pun intended), observed that the rum of a particular year was far superior to that of former or subsequent years, and he wrote to his attorney, "Pray tell me the reason why." The reply was, "You can't reasonably expect to have a nigger drowned in *every* puncheon." But it may be doubted whether the dead body of a negro would impart so delicious a flavour to the rum, except to a vitiated palate, (as George I. is said to have delighted in the oysters which he ate in Hanover, which stank, and to have regarded the fresh oysters which he got in England as insipid,) seeing that when alive it is by no means as fragrant as the rose; and it may be equally doubted whether the labour of the negro is preferable to that of others. Negro labour was first introduced into the New World in the reign of the Emperor Charles V., on the suggestion of Barthelemi de las Casas, Bishop of Chiapa. This was done from feelings of humanity—not to the negro certainly, for he was scarcely considered to belong to the family of man—but to the aboriginal Indians, who were most cruelly treated by the Spaniards. Since that time Africa has been the grand nursery for slaves, the great fountain of labour. It is much to be lamented that the discoverers and conquerors of the New World belonged to a race and a profession to whom the labour of the spade and the hoe was a degradation. Reared in the camp during the fierce conflicts which were constantly occurring between Arragon and Castile, and between those kingdoms and the Moors,—trained to arms, and habituated to plunder and all the excesses which the tented field in those days fostered and encouraged, they were daring and profligate, hardy and licentious. To them, as to ancient Pistol, "the world was their oyster, which they with sword did open." When the New World spread out its riches before them—like Pomona pouring from her lap the fruits of the earth—they buckled on their armour of proof, girded on their good swords, grasped their trembling lances, and crossed the seas in the frailest of barks, to conquer and to gather them. The idea of labour never entered into their thoughts. Had it been differently ordered—had those regions fallen into the possession of a peaceful and industrious people—a black skin would never have been seen in the colonies, slavery would never have been established, and European labourers would have turned into a garden that which is now a desert.

The colonists, then, have become habituated to the labour of Africans, and they think that it is impossible to do without it. I believe that they are very greatly in error. It has been the fashion to represent the negro as a suffering, patient, docile, simple, faithful creature. People are apt to imagine that every negro slave is an Uncle Tom, and that every owner of such slave is a Legree. But Uncle Toms are very scarce, and Legrees, unfortunately, are too plentiful in every rank and department of life. We find them amongst the nobility, amongst generals, amongst governors of colonies, amongst Judges. The noble lord who shot his gamekeeper, and was hanged for it, was a Legree. The gallant General who ordered women to be flogged was a Legree. Mrs. Brownrigg was a Legree. The Judge who condemned the Lady Lisle to be burnt was a Legree. Almost every human being has, I am afraid, got something Legreeish lurking somewhere about him. But Uncle Tom is a rare bird—he is a *niger cygnus*—he is a black cloud with a silver lining,—he is a kind of allegorical personage, representing negro virtue in the abstract, as Minerva represented wisdom, Mars war, and Venus beauty. Uncle Tom is an idea, grand, majestic, imposing. He is like the visionary republic of Plato, the new Atlantis of Bacon, the Utopia of Moore, or the Laputa of Swift. All praise to Mrs. Beecher Stowe for her philanthropic efforts. May she live a thousand years, and, as the Persians say, may her shadow never be less. But I don't agree with her. I have not an excellent opinion of the African. The good qualities which have been attributed to him—simplicity, endurance, patience, fidelity, honesty—are mythical. The negro is unimprovable. What he was a thousand years ago he is now, and what he is now he will be a thousand years hence, if the world should last so long. Send missionaries to him—teach him to read, teach him to pray. Show him the way of salvation, and place him in the right path to everlasting life. But don't bring him from his own country; leave him with his palmettoes, his calabashes, and his mangroves, his panthers, his baboons, and his lions, his flamingoes, and parroquets, his gold dust and his ivory. Where, then, are the West Indian colonists to obtain labour, if not from Africa? From India. That country is the great and true source of labour. The experiment was tried to a limited extent, and it was eminently successful. "What! employ Indians," says a choleric old gentleman, with a florid complexion, "why they'll cut all our noses off, sir!" "What! employ those horrid Indians!" exclaims a fair vestal of threescore, "Why, Lord have mercy upon us, we shall all be ravished." Now, unquestionably, whatever any eccentric gentleman may say to the contrary, the most frightful outrages were committed by the Sepoys during the late mutiny in India. But to argue from those atrocities, that the disposition of the Hindoo is by nature cruel and sanguinary, would be to commit a grievous error. During periods of extraordinary excitement, men are guilty of excesses which cannot justly be said to be the results of their natural character. During the revolution in France, when men drank of the cup of liberty for the first time, and quaffed the bowl to the very dregs, the intoxicating draught had the same effect upon them as the maddening firewater had upon the American Indian, and they perpetrated deeds at which humanity shuddered. But it would be very unfair to infer from the crimes which were then committed, that the French people are naturally a cruel race. Had there been no revolution, Robespierre, Marat, Danton, might have lived and died with the character of human and virtuous men, and, in their course through life, might have left behind them a trail of light, instead of a wake red with blood. But the revolution awakened the evil passions of their nature, and they became murderers and cut-throats. "Is thy servant a dog, to do these things," said Hazael, yet he did them. No! The Hindoo is not, as human nature goes, a bad man. He is not more san-

guinary than the rest of his sanguinary species. He is also improvable. He possesses the Asiatic intellect—that intellect which founded the most powerful monarchies, erected the most stupendous structures, achieved the most wonderful conquests of the physical obstacles of nature, and has left remains containing a hidden and mysterious meaning, which will for ever elude the grasp of modern science. We cannot do better than import from our vast Indian empire Hindoos to cultivate and people our West Indian colonies. We have the testimony of Lord Harris and Sir Henry Barkly, to prove that the Indian coolies, in Trinidad and British Guiana, made admirable labourers, and that they were extremely quiet and well-conducted. In Jamaica, it is true, the experiment was not successful. But, somehow or other, nothing does succeed there. There were, however, particular causes in that island which were adverse to the experiment. The law regulating the importation of coolies was bad; the treatment of them by many of the planters was bad; and the coolies themselves, not being from the rural districts, but being lazy, loitering vagabonds from the towns—something like the lazzaroni of Naples—were bad.

But the system on which all the coolies were engaged was vicious. The practice of procuring labour, as it were, from hand to mouth, is most objectionable. When that is pursued, the labourers, as soon as they have earned a little money, will leave the colony, and return to their own country to spend it. That was the case with the better class of coolie labourers in British Guiana and Trinidad. They hoarded their wages, and when they had accumulated a pretty good sum, they returned with it to India. But no colony can be permanently populous which depends upon such precarious supplies of labour. It may flourish by fits and starts, but not steadily and continuously. It may be compared to a wild March day, on which amidst gusts and showers a ray of sickly sunshine is occasionally seen. The farmer would sow his wheat to little purpose, if he could not command labour when it was the time to reap it. The sugar grower pursues an uncertain calling, when, although this year his gains may be large, the next year may bring him a total loss. Every colony ought to have a settled labouring population within itself, and this can never be accomplished by the system which has been hitherto pursued. Men are brought from a great distance at considerable expense, professedly for a limited term, and at tempting wages, from their wives and children. They do not emigrate. They do not bring with them their Lares and Penates. Bramah, Vishnu, and Siva are left in their accustomed niches. Their wives are embraced, their children are kissed, and they set sail for the western El Dorado, promising to return as soon as possible with its treasures,—and they *do* return. Now, this system of supplying the colonies with labour, in my opinion, is faulty, and will never succeed. I will state my own plan. Let the country from which you obtain labourers be India. Avoid Africa. Avoid China. Do not engage a single labourer from the towns. Let all be brought from the rural districts, and let them consist only of those who have been accustomed to cultivate the soil. Let them be taken, in fact, from the Indian peasantry. Bring with them their wives and children, and for every two men let there be brought three women, in order to supply deficiencies occasioned by death. When you have got them into the colonies, allot to each labourer, for his occupation only whilst he continues a labourer, a small plot of ground, and let him have one day in the week to cultivate it. Do no violence to his religious prejudices. Let him perform his superstitious worship, and celebrate his Pagan rites as much as he will, so long as he is not guilty of immorality, indecency, and inhumanity. Let him be brought over to a purer faith by reason and conviction. Omit no proper opportunity of inculcating the doctrines of Christianity. Teach him to read and write, to reflect and reason. By adopting these means, you would very soon get a labouring population much more valuable than the slaves of Cuba, or of the United States. With such a population, there is no sugar-growing country in existence which could compete with our West India colonies in that article—and not only in that article, but in cotton, rice, and a great number of other products. You would have a permanent labouring population attached to the soil, which would rapidly increase, and from which would arise in time an intelligent and respectable class, qualified to discharge the duties of many municipal offices, which class would go on improving, until from it might be selected men eminently fitted for the highest appointments in the colonies.

The star, then, of colonial prosperity is in the east. It is from that quarter, and from that alone, that we may expect to obtain the means of awakening our West India colonists from their present cataleptic condition. With thousands and tens of thousands of free and voluntary immigrants—men, women, and children—from India, immigrants who come, not like locusts, to devour every green thing, and then wing back their flight; who come, not as the swallow comes, for a season, to revel in the summer sunshine, and skim along the surface of the calm, translucent lake—immigrants who bring out with them laziness, stupidity, brutality; but immigrants, active, industrious, intelligent, and possessing an intellect capable of the greatest possible cultivation. I say, with tens of thousands of such immigrants settling down in our West India colonies, making there their homes, establishing there their "pledges to fortune," erecting there their altars, and setting up there their household gods, what might we not expect? The Spaniards, like the old Romans, accomplished great works wherever they settled,—they built magnificent cities, they erected splendid cathedrals, they constructed impregnable castles. Mexico, Havana, and Lima are their handiwork. But were Jamaica, Trinidad, and British Guiana, peopled with Asiatics, cities would soon arise in the vast untenanted wilds of those colonies, equal to any which exist in Mexico or Peru. All architecture came from the East; from the East came the art of cultivation; thence also came the principles of commerce. Men personified these arts, they deified them, and they worshipped them under the allegorical appelations of Osiris, Mercury, and Apollo. Again let us turn our eyes to the East, for from that quarter alone help can come.

I am, &c.,

R. TEMPLE.

Belize, British Honduras, September 17, 1858.

Home Correspondence.

EDUCATION BY MECHANICS' INSTITUTES.

Sir,—The importance of extending education amongst the working classes of this country by the agency of Mechanics' Institutes has not yet been sufficiently recognised, nor its means of usefulness applied with that regard to practical utility which can alone afford the hope of permanent success. It is a favourite theme at meetings on the subject of popular education, to lament that, notwithstanding the number of schools and teachers provided from various sources, there are so many who derive little or no advantage from them, owing, in some cases, to indifference, but in the majority of instances to the many means of employment at an early age. All this is too true, but many of the remedies proposed are impracticable, and, in the absence of any more attainable remedy, it would be well to direct more attention than has hitherto been done to the capabilities of Mechanics' Institutes to supply some part at least of the admitted defect.

It is not unusual at the festive gatherings of these Institutes, for public speakers to dilate on the importance of class instruction, but, although in the majority of instances such a mode of imparting information is put for-

ward as a distinguishing feature, I believe it will be found that in very few is there that systematic management which is of the first consequence to ensure efficiency. Gentlemen are elected as members of the committee who have neither the qualifications nor even the intention to fulfil the duties which properly belong to the office. Their absence, even at periodical meetings, is more often the rule than the exception. They know very little of the condition or working of the Institute, except from the report presented at the annual meeting, and then, when they hear of a decrease in the number of members, and a balance due to the treasurer, they are surprised that the public feel so little interest in their ill-performed labours.

Much of this might be prevented if the Committee were chosen of men who were able and willing to perform the duties which they undertake, and would bear in mind that a secretary, however active and intelligent, is not a substitute for their neglect. Classes may be formed and teachers appointed, but with the best intentions they will become failures if they receive none of that regular supervision which is necessary for the efficient working of any system however ingeniously devised. Perhaps one of the first elements of success in class instruction is the punctual attendance of both teachers and pupils, and this should be, as far as possible, secured by the employment of paid teachers, with such gratuitous assistance as the Institute may be able to supply. But, whatever course be pursued in this respect, the irregularity of the teacher will soon produce similar conduct in the pupils, and the failure of the class will be inevitable.

An essential condition of class instruction is punctuality, and this should be insisted upon to as full an extent as is ordinarily pursued in good schools. Arrangements should then be made for a periodical visitation of the several classes, either by a sub-committee specially appointed, or by two or more members in rotation, as may be deemed most convenient. In elementary classes, the pupils should be examined at stated intervals, and their progress from one class to another be under the control of the committee, and not left, as is too often the case, to the caprice of the pupil. The teacher should also be enjoined to keep a register of the attendance at his class, and these reports should be regularly produced at every meeting of the committee.

It may be said that such a system would involve more trouble than many men would like to undertake, but no success in this world is achieved without trouble, and if men undertake an office involving duties they should perform them, or cease to complain because their neglect is followed by failure. Huddersfield is not a town of very large population, nor does it possess any peculiar advantages over very many other towns; yet its Mechanics' Institute has often been referred to as a model of success in class instruction, and it was chosen by the Society of Arts as the place for their first experiment of a Local Examination.

It has about eighteen classes meeting every evening, or nearly ninety in the week, with nearly a thousand pupils receiving instruction in various departments, and most of them engaged during the day-time in earning their means of subsistence. Such an educational establishment has not been raised to its present state of efficiency by drawing up rules and leaving them to be carried out or not as it may happen. It has not only an active and intelligent secretary, but an energetic committee, who pride themselves on the punctuality with which their duties are performed, and they are rewarded by the success which results from their labours.

From small beginnings it has risen, by continued exertions and systematic attention, to its present eminence, and the mode of management is well-deserving the attention of those who are desirous of making Mechanics' Institutes really efficient for the purposes for which they are designed. In every town or village they may enjoy the advantages of punctuality, and much may be done by that regular supervision to which I have alluded, to render classes more successful than is usually the case. Each individual member of the committee should feel that he has undertaken a responsibility, and not the least important of his duties is to ascertain by actual inspection the regular attendance of both teachers and pupils in the classes. If this duty be performed, one feature of the Institute will prove satisfactory, and one step be gained towards the attainment of the object for which it was established. I am, &c.,

BARNETT BLAKE.

Leeds.

Proceedings of Institutions.

Crosby Hall Evening Classes, London.—The following letter has been addressed to the Editor of the *Journal*, by the Rev. Charles Mackenzie, Honorary Secretary to these Classes:—

"Crosby-hall, E.C., Oct. 16, 1858.

"Sir,—In your notice of our proceedings (which I am thankful to see in your *Journal* of yesterday) there is a misprint, which may lead to misconception, but which is not attributable to your printer. Our report in our 'Journal,' No. 15, Oct. 2, makes it appear that we had—

		Members.		£	s.	d.
In Michaelmas Term,	1857 ...	672	paying	262	0	6
In Lent ,,	1858 ...	70	,,	223	0	0
In Trinity ,,	,, ...	50	,,	180	13	6

"Whereas, the MS. stated more correctly:—

Michaelmas ...	672	...	£262	0	6
Lent ...	735	...	223	0	0
Trinity ...	506	...	180	13	6

"We endeavoured to correct this error of the press in No. 16 of our 'Journal,' published on the 9th inst., but it is no wonder that it escaped your notice.—I am, &c.,

"C. MACKENZIE, Hon. Sec."

Manchester Mechanics' Institute.—A meeting was held at this Institution on Monday evening last, the 18th inst., for the purpose of distributing the certificates awarded by the Council of the Society of Arts to students in the Manchester Mechanics' Institution. These honours were distributed by the Earl of Carlisle, K.G. Mr. Oliver Heywood, president of the Institution, occupied the chair; and there were present Mr. Mackie, the Mayor of Manchester; Mr. Harvey, Mayor of Salford; Sir G. Armitage, Sir J. Watts, Mr. Fairbairn, C.E., F.R.S.; Professor Greenwood, Principal of Owens College; Mr. L. Horner, the Rev. W. Gaskell, Mr. J. Heron, the Rev. Canon Richson, Mr. Bazley, and many of the members and friends of the Institution.—The Chairman said it was proper to enhance—if the presence of such an assemblage as this could enhance—the gratification and distinction of the victors in the recent competition for testimonials of proficiency. At the same time, those who had been unsuccessful were not to be overlooked. Many of them were men of considerable talent and ability; they were present as generous witnesses of their competitors' distinction, and they were also diligently preparing themselves for the renewed contest of next year. They needed not to be told that disappointment was the way through which most men had attained success. What would have been the position of this institution itself had its conductors been unmindful of that encouragement to perseverance? After referring to the merits of the educational experiments which are in process all over the country, the chairman said that the late examination, the third under the auspices of the Society of Arts, was the first in which members of this institution had competed. There were about 1,000 candidates, of whom this Institution sent 36. Of that number, eight failed to pass the preliminary examination, and ten of the remainder gained 19 certificates. The total number of papers sent in by the 28 was 47, many of the successful candidates having entered themselves for ex-

amination in several subjects. The simple and more useful subjects were not passed by for the higher branches of study; for the preliminary examinations were passed by the 28 with great credit. There might, however, have been some aiming too high, for while there was but one paper in chemistry, one in practical mechanics, and one in book-keeping, there were seven in geometry, and eight in algebra. It was reassuring, however, to perceive, on analysing the results, that those who competed in a plurality of subjects had been successful in a fair proportion. Mr. R. Rumney, the chairman of the class committee, stated that the educational department of the institution consisted of three divisions. First were the female day classes, which were commenced many years ago, for the purpose of giving a sound practical education to the daughters of adult members of the artizan class. These classes had been eminently successful, and they now contained as many as could be accommodated. There were at present 260 girls and young women receiving daily instruction from thirteen teachers, ten of whom had received almost their entire education in the institution. The boy's department had only been established since the opening of the new building. A person who sent his sons to be taught at the Institution had declared that for a subscription of 17s. a quarter, including membership, they were receiving quite as good, if not better education, than they had got at a school for which he had paid £12 per annum. There were 200 boys in attendance, and their classes were conducted very efficiently. In the evening classes an alteration had been made. The plan of conducting them formerly was to teach the members individually. Now the collective system was adopted, and by a proper sub-division of the members of those classes, and a frequent use of the black-board, several advantages were gained. The directors had great faith in the use of the chalk and black board; they believed there could be no efficient teaching of large classes without the general use of them, and in their selection of teachers they had had special regard to ability in handling these two instruments effectively. In Mr. Angell, the principal of these classes, they had secured a gentleman who could use both chalk and black-board with remarkable results, and such as he (Mr. Rumney) had never witnessed before. The Earl of Carlisle expressed how much pleasure he felt in having this opportunity of paying his respects and homage to old acquaintance. It was now—he feared it must be confessed—above a quarter of a century since he paid his last visit to the members of the Mechanics' Institute of Manchester. He was delighted to find how much more handsomely and commodiously the members were now accommodated, and he did not see why they should not all enter into an engagement with each other to meet again at the end of another quarter of a century. At the end of that time no doubt it would be impossible for any room to contain their greatly augmented numbers short of the great Free Trade Hall. He heard the most favourable reports of the progress of the institution and of the benefits it had been privileged to confer upon the important and populous district in the heart of which it was established. A most pleasing thing it certainly was to find that in a town like Manchester, the foremost town in all the world for mechanical invention and ingenuity —which invention and ingenuity could not be better represented than by the eminent gentleman near him, Mr. William Fairbairn—that in such a town, absorbed necessarily to a great extent in material pursuits, there was suitable provision made for the intellectual, the mental, and the higher qualities of our nature. Amongst the many institutions in the city having this elevating mission in view, there was every reason to believe that the Mechanics' Institute most creditably and laudably performed its part. He learnt that, besides the general arrangements of a mechanics' institute—its reading and news-room, and its library of books—they had female day classes, which, at the period of their last report, contained 219 pupils; besides which, there were persons giving their attention to special branches of instruction, such as music, dancing, drawing, modelling, French, and even millinery—no doubt an important pursuit in its way—a number of persons which, with the day classes, raised the whole number to 441; that the evening male classes were attended by no less than 833 students, and that there were classes for boys which comprehended 166 pupils. He believed these last classes had only been nine months in operation; they were now increasing, and with a longer period of time before them, they would show how well they could earn their honours. He found that there was attached to the institution a working man's college, which he trusted was destined to confer solid advantage upon the great working community of the town. He thought it important that the directors and members should study how to make their institution attractive and amusing—he almost shrunk from using that word—but he meant "cosy"—as well as dignified and instructive. If it was thus furnished with all the attractions which, consistently with its character and constitution, it was capable of, the directors would not then compel, but induce people to come to and maintain their connexion with it. This bore upon the question of the propriety and advantage of keeping up as much social intercourse as possible, and the friends and members of all such institutions would show great wisdom in promoting such a spirit of good fellowship, and in maintaining as much *esprit de corps* as possible. He rejoiced that the institution still continued to be managed by directors elected by the members from their own body, for that was the way, he was confident, of giving satisfaction and inspiring interest. They had been told that of the 28 candidates from the institution, at the recent examination of the Society of Arts, 10 succeeded and 18 failed. Though failure could never be looked upon as a pleasing subject for comment, he yet did not think it to be regretted that there should, particularly at the outset of such examinations, be a certain proportion of failures. They showed that the work was done in earnest—that there was no sham about it; in fact, the giving too large a number of prizes or certificates took away all the real value and honour of such distinctions. Those young persons—he supposed they were mostly so—upon whom were to be conferred honours that evening, he would cordially congratulate upon their success; and he would earnestly exhort them to pursue the honourable and laudable career upon which they seemed to have entered. He would impress upon all—both on those upon whom he was about to confer these well-earned marks of honour and distinction, and those who had laudably, although not in this instance successfully, engaged in the struggle—that wherever their after destinies might carry them, the work of education, properly so considered, did not terminate with the class room, or the professor's lecture, or the institute. Every succeeding day of their lives might add to their knowledge, and every passing moment of their time might promote their personal improvement. They should strive, by every means in their power, to attain to the highest degree of usefulness to the generation in which they lived. But at the same time, while they strained their utmost endeavours to attain the highest degree of usefulness, they should be content with any opportunity they had of being useful, even in the humblest way. The statues of Watt and Dalton adorned one of the noble spaces in that town; but it was not everyone that could hope to be a Watt or a Dalton, any more than it was given to any set of men to become Shakspeares or Miltons:—

> "For not to one in this benighted age,
> Is that diviner inspiration given,
> That glows in Milton's or in Shakspeare's page—
> The pomp and prodigality of Heaven."

But because they could not attain to the very brightest and most immortal chaplets of literature, that was no reason why the common, smooth, and current paths of

literature and of knowledge should be neglected. The aristocracy of genius was indeed more limited than all the other aristocracies. But the aristocracy of virtue had this peculiarity in it, differing from all other aristocracies—that it might be co-extensive with all mankind; and it was their own fault if they did not each of them make one of that peerless aristocracy.—The noble earl then proceeded to distribute the certificates, and the meeting terminated with votes of thanks to the Earl of Carlisle and to the Chairman.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 15, 1858.]

Dated 6th September, 1858.

2014. J. Fielden, Woodshade, near Todmorden, Lancashire—An imp. or imps. in the construction or building of cops, whether of cotton, flax, silk wool, or other fibrous materials, and also for certain utensils thereunto conducing or belonging.

Dated 9th September, 1858.

2042. W. Taylor and P. A. Baugh, Nursling, Hampshire—An improved apparatus for propelling ships or other navigable vessels through water.

Dated 17th September, 1858.

2100. G. Prax, Paris—Imp. in apparatus for separating the liquid from the solid portions of fecal matters.

Dated 18th September, 1858.

2106. J. Luis, 1B, Welbeck-street, Cavendish-square—A new manner for applying centrifugal force in the manufacture of the fecula of potatoes, of starch, of yeast, of porcelain paste, of paper pulp, and ultramarine, and the apparatus for carrying out the same. (A com.)
2108. J. B. Beasley, Cashel, Ireland—Imp. in the construction of sporting and all other guns.
2110. H. W. Grylls, 47, Mark-lane—Imp. in apparatus employed in submerging or laying down electric telegraph cables.

Dated 20th September, 1858.

2114. H. Firmin, Wapping—A machine for cleansing chaff and other food for horses and cattle.

Dated 21st September, 1858.

2116. G. M. Levi, Maida-vale, Middlesex—Imp. in the manufacture of iron in the blast furnace. (A com.)
2118. G. Dowler, Birmingham, and T. T. Chellingworth, West Bromwich, Staffordshire—An adjustable torsion spring for doors or other purposes.
2120. J. C. E. Malvezin, Paris—Imp. in the manufacture of tubes, pipes, or mains, for conducting liquids or gas, or for other similar purposes.
2122. A. V. Newton, 66, Chancery-lane—An improved machine for sweeping carpets and floors. (A com.)
2124. A. M. Perkins, Francis-street, Gray's-inn-road—Imp. in surface condensers.

Dated 22nd September, 1858.

2126. T. B. Hubbell, Regent-street—An imp. in hooped petticoats. (A com.)
2130. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for printing shawls and other articles. (A com.)
2134. J. Spence, Liverpool—Imp. in the manufacture of steel, and in the furnaces employed in such manufacture.

Dated 23rd September, 1858.

2136. Earl of Dundonald, 12, Queen's-gate, South Kensington—An improved machinery or apparatus for tilling and preparing land for cultivation.
2138. H. McGrady, 21, Bridge street, Blackfriars—Imp. in the construction of flues, boiler and other furnaces, and in certain appliances thereto.
2140. D. Grant, Ludgate-hill—Imp. in colour-printing presses.

Dated 24th September, 1858.

2142. P. Pickering, Danzig, Prussia—An atmospheric engine.
2143. R. Ford and W. Ford, 4, Nelson-street, Perth, Scotland—Smoke consuming by means of a reciprocating or reversing fire.
2145. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of pile and cut pile fabrics, and in machinery employed therein. (A com.)
2146. H. H. Henson and W. F. Henson, 38, Parliament-street—Imp. in waterproofing leather woven fabrics, fibrous and other materials, and also for rendering them fire-proof, or partially fire-proof.
2147. R. Bodmer, 2, Thavies-inn, Holborn—An improved apparatus for preventing explosions in steam boilers. (A com.)
2148. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the construction of spinning cards. (A com.)
2149. W. Richards, Birmingham—Imp. in fire-arms and cartridges.
2150. G. L. Fuller, Lombard-street—Imp. in steam engines.
2151. G. L. Turney, Aldermanbury—An improved mode of packing pins for sale.

Dated 25th September, 1858.

2153. R. Romaine, 12, Chapel-street, Bedford-row—Imp. in the construction of steam cultivators, and in the means for operating such and other locomotive steam engines.
2155. E. Farncomb, Lambeth—Imp. in lilliputian fire-arms.
2157. W. Clark, 53, Chancery-lane—Imp. in purifying natural phosphates of lime. (A com.)

Dated 27th September, 1858.

2159. S. H. Greaves, Radford-street Works, Sheffield—Imp. in the mode of manufacturing the blades of table and other knives.
2161. W. Lander, Bristol—Imp. in engraving and printing, for the purpose of ornamenting china and earthenware.
2163. W. E. Newton, 66, Chancery-lane—Imp. in cigar holders or mouth pieces for cigars, and in pipes for smoking tobacco. (A com.)

Dated 28th September, 1858.

2165. B. Jones, York—Imp. in press wheel rollers or clod crushers, which imps. are also applicable to rollers for crushing, bruising, and pulverizing roots and other substances.
2167. G. Mead, 7, Westside, Cambridge-road, Bethnal-green—Imp. in the construction of tobacco pipes.

Dated 29th September, 1858.

2169. J. Manning, Cambridge, and T. Paul, Houghton, Huntingdonshire—An improved stone staff to be used in dressing millstones.
2171. G. Old, Aston, near Birmingham, and T. Pendleton, Birmingham—Imp. in dress-fastenings, and in attaching dress-fastenings to articles of dress.

Dated 30th September, 1858.

2173. T. Britt, 9, St. Thomas-terrace, Church-street, Old Kent-road, Camberwell—An imp. in the propelling of steam-boats.
2175. J. Morrison, Birmingham—An imp. in, or addition to, sewing machines.
2177. L. Cecconi, 12, Great Newport-street—Imp. in the construction of cornets, trumpets, horns, and other wind instruments of a like nature.
2179. R. Levy, Manchester—Imp. in the manufacture of coats, ladies' riding habits, and other similar garments.
2181. A. Normand, Havre, France—Constructing ships and vessels propelled by screw or such like propellers.
2183. J. J. Russell, Wednesbury, Staffordshire—Imp. in furnaces for heating iron and steel, suitable for the manufacture of welded tubes and other articles.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2249. C. E. Bull, Wells, Norfolk—An apparatus for containing and preserving articles of value from loss or damage in cases of shipwreck.—9th October, 1858.
2265. A. Von Schuttenbach, St. Petersburgh—Imp. in lamps.—11th October, 1858.
2277. M. Sautter, Paris, Boulevart Montmartre, 14—Imp. in air-engines.—12th October, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Oct.* 15, 1858.]

October 15th.

708. J. H. Johnson.
818. J. Meyers.
820. W. E. Newton.
848. J. G. Jennings.
881. W. H. Ridgway.
854. H. Edwards.
873. M. Ross.
942. M. A. F. Mennons.
944. E. Tomlinson.
961. J. Chadwick A. Elliott, and W. Robertson.
973. A. Smith.
1020. J. Castle.
1038. R. B. Goldsworthy.
1118. W. E. Newton.
1166. C. F. D. Monnin.
1202. M. A. F. Mennons.
1320. W. Davis.
1659. L. J. Marks.
1764. A. V. Newton.
1971. M. A. F. Mennons.

[*From Gazette, Oct.* 19, 1858.]

October 19th.

876. J. Horsey.
877. E. Green & E. Green, jun.
879. B. Parker.
880. W. Bishop.
883. J. Chatterton.
884. G. Gilmour.
887. P. Maugey.
890. P. E. Aimont.
892. J. B. Paddon.
894. T. Donkin.
897. C. Atkinson.
898. H. J. Sillem.
899. J. P. Pirsson.
903. C. Lungley.
904. A. S. Stocker.
908. F. Lillywhite & J. Wisden.
914. J. M. Fisher.
916. J. Westerby.
926. E. White.
946. W. Clark.
959. D. Auld.
969. W. Clark.
987. W. Clark.
1021. R. Openshaw.
1159. W. Harding.
1177. J. Luis.
1329. W. E. Newton.
1454. J. Morgan.
1603. T. Leigh.
1624. T. Greenwood, J. Batley, and J. Salt.
1724. H. Bessemer.
1769. J. J. Russell.
1810. H. Clayton.
1925. J. Biggs.
1977. J. H. Johnson.
1979. William Rose.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Oct.* 15, 1858.]

October 11th.

2296. G. T. Bousfield.
2298. G. T. Bousfield.
2337. Dr. Graham.

October 12th.

2302. T. W. Dodds.

[*From Gazette, Oct.* 19, 1858.]

October 14th.

2311. E. Wilkinson.
2317. H. Bessemer.
2319. H. Bessemer.

October 15th.

2321. H. Bessemer.
2325. H. Bessemer.
2327. H. Bessemer.
2331. J. Adcock.
2359. A. Parkes.

October 16th.

2336. S. Statham.
2344. W. Smith.
2345. W. Basford.

Journal of the Society of Arts.

FRIDAY, OCTOBER 29, 1858.

MEETING OF COUNCIL.

At a Meeting of the Council, held on Wednesday last, the following Institutions were received into Union:—

Bristol, Young Men's Christian Association and Literary Institute.

Willenhall, Reading and Literary Society.

PHOTOGLYPHIC ENGRAVING.

The following is a description of Mr. Fox Talbot's new discovery of a means by which a photograph may be transferred direct to copper or steel plate, taken from the specification of the patent which has just been enrolled:—

"In this invention I employ plates of steel, copper, or zinc, such as are commonly used by engravers. Before using a plate its surface should be well cleaned; it should then be rubbed with a linen cloth, dipped in a mixture of caustic, soda, and whiting, in order to remove any remaining trace of greasiness. The plate is then to be rubbed dry with another linen cloth. This process is then to be repeated; after which the plate is in general sufficiently clean.

"In order to engrave a plate I first cover it with a substance which is sensitive to light. This is prepared as follows:—About a quarter of an ounce of gelatine is dissolved in eight or ten ounces of water, by the aid of heat. To this solution is added about one ounce, by measure, of a saturated solution of bichromate of potash in water, and the mixture is strained through a linen cloth. The best sort of gelatine for the purpose is that used by cooks and confectioners, and commonly sold under the name of gelatine. In default of this, isinglass may be used, but it does not answer so well. Some specimens of isinglass have an acidity, which slightly corrodes and injures the metal plates. If this accident occurs, ammonia should be added to the mixture, which will be found to correct it. This mixture of gelatine and bichromate of potash keeps good for several months, owing to the antiseptic and preserving power of the bichromate. It remains liquid and ready for use at any time during the summer months; but in cold weather it becomes a jelly, and has to be warmed before using it; it should be kept in a cupboard or dark place. The proportions given above are convenient, but they may be considerably varied without injuring the result. The engraving process should be carried on in a partially darkened room, and is performed as follows:—A little of this prepared gelatine is poured on the plate to be engraved, which is then held vertical, and the superfluous liquid allowed to drain off at one of the corners of the plate. It is held in a horizontal position over a spirit lamp, which soon dries the gelatine, which is left as a thin film, of a pale yellow colour, covering the metallic surface, and generally bordered with several narrow bands of prismatic colours. These colours are of use to the operator by enabling him to judge of the thinness of the film; when it is very thin, the prismatic colours are seen over the whole surface of the plate. Such plates often make excellent engravings; nevertheless, it is perhaps safer to use gelatine films which are a little thicker. Experience alone can guide the operator to the best result. The object to be engraved is then laid on the metal plate, and screwed down upon it in a photographic copying frame. Such objects may be either material substances, as lace, the leaves of plants, &c., or they may be engravings, or writings, or photographs, &c. The plate, bearing the object upon it, is then to be placed in the sunshine, for a space of time varying from one to several minutes, according to circumstances; or else it may be placed in common daylight, but of course for a long time. As in other photographic processes, the judgment of the operator is here called into play, and his experience guides him as to the proper time of exposure to the light. When the frame is withdrawn from the light, and the object removed from the plate, a faint image is seen upon it—the yellow colour of the gelatine having turned brown wherever the light has acted. This process, so far as I have yet described it, is, in all essential respects, identical with that which I described in the specification of my former patent for improvements in engraving, bearing date the 29th October, 1852.

"The novelty of the present invention consists in the improved method by which the photographic image, obtained in the manner above described, is engraved upon the metal plate. The first of these improvements is as follows:—I formerly supposed that it was necessary to wash the plate bearing the photographic image in water, or in a mixture of water and alcohol, which dissolves only those portions of the gelatine on which the light has not acted; and I believe that all other persons who have employed this method of engraving, by means of gelatine and bichromate of potash, have followed the same method, viz., that of washing the photographic image. But however carefully this process is conducted, it is frequently found, when the plate is again dry, that a slight disturbance of the image has occurred, which, of course, is injurious to the beauty of the result; and I have now ascertained that it is not at all necessary to wash the photographic image; on the contrary, much more beautiful engravings are obtained upon plates that have not been washed, because the more delicate lines and details of the picture have not been at all disturbed. The process which I now employ is as follows:—When the plate bearing the photographic image is removed from the copying-frame, I spread over its surface, carefully and very evenly, a little finely-powdered gum-copal (in default of which common resin may be employed). It is much easier to spread this resinous powder evenly upon the surface of the gelatine than it is to do so upon the naked surface of a metal plate. The chief error the operator has to guard against is that of putting on too much of the powder; the best results are obtained by using a very thin layer of it, provided it is uniformly distributed. If too much of the powder is laid on, it impedes the action of the etching liquid. When the plate has been thus very thinly powdered with copal, it is held horizontally over a spirit-lamp, in order to melt the copal; this requires a considerable heat. It might be supposed that this heating of the plate, after the formation of a delicate photographic image upon it, would disturb and injure that image, but it has no such effect. The melting of the copal is known by the change of colour. The plate should then be withdrawn from the lamp, and suffered to cool. This process may be called the laying of an aquatint ground upon the gelatine, and I believe it to be a new process. In the common mode of laying an aquatint ground, the resinous particles are laid upon the naked surface of the metal, before the engraving is commenced. The gelatine being thus covered with a layer of copal, disseminated uniformly and in minute particles, the etching liquid is to be poured on. This is prepared as follows:—Muriatic acid, otherwise called hydrochloric acid, is saturated with peroxide of iron, as much as it will dissolve with the aid of heat. After straining the solution, to remove impurities, it is evaporated till it is considerably reduced in volume, and is then poured off into bottles of a convenient capacity; as it cools it solidifies into a brown semi-crystalline mass. The bottles are then well corked up, and kept for use. I shall call this pre-

paration of iron by the name of perchloride of iron, in the present specification, as I believe it to be identical with the substance described by chemical authors under that name, for example, see 'Turner's Chemistry,' fifth edition, page 537; and by others called permuriate of iron; for example, see 'Brande's Manual of Chemistry,' second edition, vol. ii., page 117.

"It is a substance very attractive of moisture. When a little of it is taken from a bottle, in the form of a dry powder, and laid upon a plate, it quickly deliquesces, absorbing the atmospheric moisture. In solution in water, it forms a yellow liquid in small thicknesses, but chestnut-brown in greater thicknesses. In order to render its mode of action in photoglyphic engraving more intelligible, I will first state that it can be usefully employed in common etching; that is to say, that if a plate of copper, steel, or zinc is covered with an etching-ground, and lines are traced on it with a needle's point, so as to form any artistic subject, then, if the solution of perchloride of iron is poured on, it quickly effects an etching, and does this without disengaging bubbles of gas or causing any smell; for which reason it is much more convenient to use than aquafortis, and also because it does not injure the operator's hands or his clothes if spilt upon them. It may be employed of various strengths for common etching, but requires peculiar management for photoglyphic engraving; and, as the success of that mode of engraving chiefly turns upon this point, it should be well attended to.

"Water dissolves an extraordinary quantity of perchloride of iron, sometimes evolving much heat in the solution. I find that the following is a convenient way of proceeding:—

"A bottle (No. 1) is filled with a saturated solution of perchloride of iron in water.

"A bottle (No. 2) with a mixture, consisting of five or six parts of the saturated solution and one part of water.

"And a bottle (No. 3) with a weaker liquid, consisting of equal parts of water and the saturated solution. Before attempting an engraving of importance, it is almost essential to make preliminary trials, in order to ascertain that these liquids are of the proper strengths. These trials I shall therefore now proceed to point out. I have already explained how the photographic image is made on the surface of the gelatine, and covered with a thin layer of powdered copal or resin, which is then melted by holding the plate over a lamp. When the plate has become perfectly cold, it is ready for the etching process, which is performed as follows:—A quantity of the solution in bottle No. 2, viz., that consisting of five or six parts of saturated solution to one of water, is poured upon the plate, and spread with a camel-hair brush evenly all over it. It is not necessary to make a wall of wax round the plate, because the quantity of liquid employed is so small that it has no tendency to run off the plate. The liquid penetrates the gelatine wherever the light has not acted on it, but it refuses to penetrate those parts upon which the light has sufficiently acted. It is upon this remarkable fact that the art of photoglyphic engraving is mainly founded. In about a minute the etching is seen to begin, which is known by the parts etched turning dark brown or black, and then it spreads over the whole plate—the details of the picture appearing with great rapidity in every quarter of it. It is not desirable that this rapidity should be too great, for, in that case, it is necessary to stop the process before the etching has acquired sufficient depth (which requires an action of some minutes' duration). If, therefore, the etching, on trial, is found to proceed too rapidly, the strength of the liquid in bottle No. 2 must be altered (by adding some of the saturated solution to it) before it is employed for another engraving; but if, on the contrary, the etching fails to occur after the lapse of some minutes, or if it begins, but proceeds too slowly, this is a sign that the liquid in bottle No. 2 is too strong, and too nearly approaching saturation. To correct this, a little water must be added to it before it is employed for another engraving. But, in doing this, the operator must take notice, that a very minute quantity of water added often makes a great difference, and causes the liquid to etch very rapidly. He will therefore be careful, in adding water, not to do so too freely. When the proper strength of the solution in bottle No. 2 has thus been adjusted, which generally requires three or four experimental trials, it can be employed with security. Supposing, then, that it has been ascertained to be of the right strength, the etching is commenced as above mentioned, and proceeds till all the details of the picture have become visible, and present a satisfactory appearance to the eye of the operator, which generally occurs in two or three minutes, the operator stirring the liquid all the time with a camel-hair brush, and thus slightly rubbing the surface of the gelatine, which has a good effect. When it seems likely that the etching will improve no further it must be stopped. This is done by wiping off the liquid with cotton wool and then rapidly pouring a stream of cold water over the plate, which carries off all the remainder of it. The plate is then wiped with a clean linen cloth, and then rubbed with soft whiting and water to remove the gelatine. The etching is then found to be completed.

"I will now describe another etching process, very slightly differing from the former, which I often use. When the plate is ready for etching, pour upon it a small quantity of the liquid (No. 1—the saturated solution.) This should be allowed to rest upon the plate one or two minutes. It has no very apparent effect, but it acts usefully in hardening the gelatine. It is then poured off from the plate, and a sufficient quantity of solution (No. 2) is poured on. This effects the etching in the manner before described, and, if this appears to be quite satisfactory, nothing further is required to be done. But it often happens that certain faint portions of the engraving, such as distant mountains or buildings in a landscape, refuse to appear; and as the engraving would be imperfect without them, I recommend the operator, in that case, to take some of the weak liquid (No. 3) in a little saucer, and without pouring off the liquid (No. 2) which is etching the picture, to touch with a camel hair-brush, dipped in liquid No. 3, those points of the picture where he wishes for an increased effect. This simple process often causes the wished for details to appear, and that, sometimes, with great rapidity, so that caution is required in the operator, in using this weak solution (No. 3) especially, lest the etching liquid should penetrate to the parts which ought to remain white; but, in skilful hands, its employment cannot fail to be advantageous, for it brings out soft and faint shadings, which improve the engraving, and which would otherwise probably be lost. Experience is requisite in this, as in most other delicate operations connected with photography, but I have endeavoured clearly to explain the leading principles of this new process of engraving, according to the method I have hitherto found the most successful."

BRITISH ASSOCIATION, LEEDS, 1858.

Reaping Machinery.

The following paper was read before the Mechanical Section by Alfred Crosskill:—

The paper on Reaping Machinery which I read before the Mechanical Section in the year 1853, at the meeting of the British Association in Hull, contained a general history of all the early inventions for reaping on record, none of which excited any interest, or were generally known to the public, prior to the Great Exhibition of 1851, when the introduction there of two reaping machines from America drew general attention to the subject. Mr. Garrett, Messrs. Ransomes (of Ipswich), Mr. Samuelson, and the father of the writer (Mr. William

Croskill) immediately took a prominent part in introducing reaping machinery into the harvest-fields of this country; and Mr. Croskill succeeded in bringing into general notice, and subsequently into practical operation, a reaper which had been in existence in Scotland, and worked there by its owner, for nearly twenty years, but which, for want of practical knowledge in perfecting its mechanical construction, had scarcely been heard of during that time beyond the limits of the district in which it was originally put together.

The two American reapers, known respectively as Hussey's and M'Cormick's, and the Scotch machine, called "Bell's," after its originator, who was a minister in Fifeshire, were in 1853 the only implements capable of doing any practical work in the harvest-fields; and though they have during the succeeding five years been greatly improved, modified, and re-constructed as experience has shown to be necessary to meet the varied requirements of English agriculture, they still retain their distinctive peculiarities sufficiently to divide reaping machines into three separate classes or varieties, and all the schemes and novelties which have been brought forward since the year 1852 have either failed and been laid aside, or have resolved themselves into variations of one of the three machines first established.

Before describing the fundamental differences in the construction of these three reapers, and briefly indicating the important improvements that have been made in them since their introduction, it is desirable briefly to point out the work which has to be accomplished by an efficient machine for reaping. Most inventors or mechanics who for the first time turn their attention to this subject occupy themselves almost exclusively with the cutting apparatus, apparently overlooking that the convenient disposal or delivery of the cut corn is a very important part of the functions of reaping machines, and has, in fact, been the real difficulty in bringing them into practical use. The cutting parts of all the reapers have for a length of time been sufficiently perfect to encounter successfully every crop that they can reasonably be required to cut; but to obtain an efficient means of delivery has taxed to the utmost the patience, perseverance, and ingenuity of all who have been engaged with the subject, and considerable difficulty has been experienced in perfecting an arrangement that will satisfactorily deliver all descriptions of grain.

The only efficient cutting apparatus hitherto brought into practical use consists of a series of V-shaped knives fixed side by side on a light moveable bar, extending across the whole width of the front part of the reapers, and connected, by means of gearing and a crank, to the main wheels which carry them, so that as they travel forwards a rapid reciprocating motion is communicated to the knives. They pass between and cut against fixed guards or fingers, which support the straw and prevent it from yielding sideways, and serve also to protect the knives from injury on rough and stony ground.

The shape of the knives varies in the different machines; in Hussey's they form a very acute angle with the guards, are plain-edged, sharp, and chop off the straw by means of their rapid motion through the fingers. Mr. M'Cormick's knife has a serrated edge with an obtuse angle, and requires the aid of a fan or reel to hold the corn in order to cut clean, but it is much more easily worked, more durable, and less liable to choke, than Hussey's, and by those who have tried both is generally preferred. Bell's original machine cut by means of shears resembling large sissors; but though very efficient in operation they were found difficult to keep in order, and a serrated knife something like M'Cormick's was substituted for the shears in the year 1854, and has been successfully used since that time. An inspection of the models will enable any one to understand the general action of the cutters and guards, and the special difference between each variety of knife is shown by the specimens on the table.

It is worthy of remark in connection with the cutting apparatus, that numerous endeavours have from time to time been made to supersede the necessity of giving a reciprocating motion to the knives, as the reverse action is a source of considerable loss of power, and the tremulous vibration it produces in the machines is a great cause of their wear and tear. All attempts have, however, hitherto failed in producing an efficient cutter with a continuous motion, and in the opinion of the writer there is little probability of their success, as actual experience in the harvest-field seems to prove that the reverse or reciprocating motion of the bar and knives is necessary to shake out from the guards pieces of short straw, grass, weeds, and other substances which constantly collect there, and if not quickly removed soon choke them up and stop the action of the cutters. A complete collection of all the schemes known to have been projected for cutting corn, was published by Mr. Woodcroft, of the Patent Office, in the year 1852, and forms a record worthy of the attention of the curious in such matters; it should serve also as a warning to inventors generally to make actual trials of their crude schemes before wasting their money in taking out patents for them, as the great majority turn out entirely worthless in practice.

The different methods of delivering the cut corn will be best understood from a brief description of how it is disposed of by each machine, beginning with Hussey's, which is the simplest, and may be termed the elementary reaper. In this implement the corn falls, as it is cut, upon a platform behind the knives; a man rides on the box which covers the wheels and other gearing, and forms a seat for him; and as soon as a sufficient quantity has collected to form a sheaf, he pushes it off the platform by means of a rake with which he is provided. When this operation is performed by a skilful workman on a moderately light crop, which can be managed without too much exertion, it has a particularly neat and tidy appearance, the corn is left in sheaves, ready for binding immediately; and the result is attained by the simplest possible means, as there is no gearing required except that for driving the cutters; and the simplicity of the implement contrasts strikingly with others which have machinery necessarily more or less complicated for effecting the delivery of the cut corn. On the other hand, to do the work neatly and efficiently, requires a man both strong and skilful, especially where the crops are heavy, and such a man is not always to be obtained. It is, therefore, not surprising that this machine is much better liked in America, where the crops are generally thin and light, than in this country, where on all good farms the weight of the produce is too great to admit of its being readily moved as fast as cut by the unaided strength of a single workman. It will also be observed that the sheaves are deposited on the ground behind the machine, and must therefore be removed out of the way of the horses before they can pass to make the next cut; and in practice this is found a great disadvantage in comparison with the work of the machines with self-acting deliveries, which deposit the cut corn on one side, so that its instant removal is not necessary.

M'Cormick's reaper, as first introduced from America in 1851, resembled Hussey's in requiring a man to ride on it for the purpose of raking off the cut corn, but the gearing was placed before the platform, so that the sheaves could be raked off to the side of the machine, where they were out of the way of the horses when making the next cut; but the work of the man was far more laborious than with Hussey's reaper; and in most of the heavy crops of this country it could not be performed. This difficulty with M'Cormick's machine was overcome by Messrs. Burgess and Key, of London, who constructed and patented for it a self-acting apparatus for delivering, consisting of three rollers in the form of endless screws, which carry the cut corn off at the side of the machine, and leave it in a continuous swathe ready for taking up and binding. The engraving of the reaper at work shows

the action of the screw delivery, and is a very good representation of the implement drawn by two horses and driven by a boy. Since the introduction of Messrs. Burgess and Key's improvements, this machine has been very extensively used; and when managed with proper care and attention, is capable of doing excellent service.

In Bell's reaper, as improved and re-constructed at Beverley, under the direction of the writer, the delivery is effected by means of a number of endless bands of vulcanized Indian rubber, fitted with projecting pieces of wood, which carry the cut corn to the side of the machine and deposit it on the ground in a regular and continuous swathe, as shown in the engraving. In the original machine a cloth carried along by pitch chains was employed for this purpose, but the bands are found equally efficient, not so liable to get out of order, and more easily worked by the horses than the cloth and pitch-chains. The large model on the table is fitted with the shears and the cloth, as used in the original machine; the small models show the improvements which have been made in it, and the form in which it has been practically found to work best.

It will be observed that both the machines, with self-acting delivery, leave the corn in a continuous swathe, which must be raked together for binding, and a practically useful intermittent, or sheaf-delivery has not yet been effected by machinery, although several attempts have, from time to time, been made to accomplish it.

A cursory inspection of the models and engravings shows a striking difference in the general arrangement and construction between Bell's reaper and that of both the American machines just described. In the latter the horses walk by the side of the corn to be cut, and draw by means of a pole connected to one side or end of the machine, a mode of attachment productive of considerable twist or torsion, especially when the work is severe. Bell's machine goes before the horses, and is propelled by means of a long pole passing between them, to the end of which they are harnessed, and by means of which the man who follows and drives them steers the reaper in any direction. This mode of attachment is attended with the great advantage of enabling the machine to deliver the cut corn on either side, while all the reapers which have the horses in front are confined to one side only for delivery, and cannot go backward and forward along a field, but must either go round the crop, or, when circumstances render this impracticable, must return idle; on the other hand, machines having the horses in front are somewhat more manageable and easily turned than Bell's, and, in cases of need, a third horse can be yoked in front, which is not practicable when the machine is placed first. For these and other reasons connected with practical convenience, both makers and users of reapers are much divided in opinion as to which is the best way of attaching the horses. Both methods have warm advocates, and it appears probable that until considerably more experience has been gained in the practical use of reaping machinery, and perhaps even after that, on account of the variation in convenience under different circumstances, both methods will continue to be employed.

It will be observed, also, both the machines with self-acting delivery, carry in front of the cutters an apparatus called a fan or reel, which revolves slowly as the machine advances, puts back the corn, and insures its falling in the proper direction; an operation which in Hussey's machine is done, when necessary, by the man with the rake.

A general description of reaping machinery would not be complete without an allusion to various ingenious contrivances which have been projected from time to time for the purpose of delivering the cut corn. Through the kindness of Messrs. Ransomes and Sims, of Ipswich, I am able to exhibit a working model of one of these, consisting of an exceedingly curious automaton or self-acting rake, invented by a youth in America, named Atkins, and sent over to England in 1853. It was applied to a machine similar in construction to Hussey's, and was intended to deposit the corn on the ground in sheaves; but it has not yet been made to do so in a sufficiently perfect manner to justify its general introduction, although its extreme beauty and ingenuity lead to the hope that it will at some time be turned to account. Another machine, with a very clever contrivance for giving a self-acting motion to a rake for performing the work done by the man on Hussey's reaper, has just been sent over from the United States to Mr. Samuelson, of Banbury, by Messrs. Seymour and Morgan, of Brockport, near New York; it has been named the "Britannia Reaper," and the *Mark Lane Express* and other agricultural journals contained last week accounts of various successful trials that have just been made with it in the North of England. Having seen it for the first time on Monday last, I have been unable to get a model of it for exhibition here, and the mechanical arrangements are so peculiar, that a description of them would be unintelligible without a model. I may state, however, that there is every probability of its turning out practical and useful as well as ingenious, and in the hands of Mr. Samuelson we may rest assured that its capabilities will be fully developed.

In making a few observations on the practical use of reaping machinery, it is necessary to direct attention to the extremely variable and uncertain nature of the circumstances under which it has to operate. A week of heavy rain before harvest will sometimes lay the corn in whole districts, so that it cannot even be mown with a scythe, and it is not probable that machinery will ever be made to work under unfavourable circumstances of this description. It is, however, certain that the reapers as at present constructed are able to render important assistance to the farmer in moderately favourable seasons.

The use of both reaping machines with self-acting delivery is steadily extending; and as agriculturists and their men become more accustomed to them, their introduction will be still more rapid; for, owing to the high price of labour during harvest, they effect a considerable saving in the cost of cutting the crop, and enable the farmer to take more advantage of favourable weather than he can do by the uncertain aid of the limited number of men that can be procured at that period of the year.

It is also worthy of remark in connection with this part of the subject, that, excepting the locomotive engine, there is no machine in use which requires to be manufactured with so much care and regard to durability as the reaper. Almost all other machines used either in agriculture or manufactures do their work when at rest, and secured to substantial foundations. Even those constructed to move from place to place are, before being put in motion, fastened down, to prevent, as far as possible, the destructive consequences of oscillation and vibration. The reaper is, on the contrary, not only exposed to all the strains consequent on passing over every description of uneven ground with its machinery in action, but it is also subject to the effects of continual tremulous vibration, caused by the quick reciprocating motion of the knives.

It is, therefore, not surprising that the introduction of reaping machines has been attended with considerable difficulties, especially as they have had to be worked by men but little accustomed to the use of machinery. In this respect, however, the last few years have witnessed a great change. The assistance of the steam engine is already felt by most farmers to be a necessity in carrying on all extensive operations with efficiency and economy, and the general use of improved machinery cannot fail to produce a corresponding improvement in the condition of the agricultural labourer, and will accelerate the completion of that progressive revolution which, since the abrogation of legislative protection, has been rapidly taking place in every department of practical agriculture.

The Manufacture of Iron in the Neighbourhood of Leeds.

The following paper, by W. J. Armitage, was read before the Mechanical Section:—

The object I have had in view in collecting the following facts, is to bring before the notice of this section of the British Association a few points connected with the manufacture of pig metal and iron in the neighbourhood of this town.

As an introduction to the remarks I have to make, allow me to refer you to a paragraph in reference to this district, contained in the memoir of the "Geological Survey of Great Britain, and of the Museum of Practical Geology for 1856.

"The coal field of Yorkshire may be considered, especially in respect to its iron manufacture, as admitting of division into two parts, the northern and southern districts. In the former, the lower part of the strata is developed to a degree of importance not seen in the south, by the occurrence of the beds of ironstone and coal, which have given rise to the establishments of Lowmoor, Bierley, and Bowling, celebrated for the production of the best irons in Britain, and to that of Farnley, which is following in the same steps.

"The castings from these works are largely employed for special purposes where strength and tenacity are required, as for mortars and sea-service guns. Their wrought-iron has the peculiarity of a granular structure, with a uniform small and brilliant grain, which closely resembles the character of Swedish bars. The superiority of the North Yorkshire iron proceeds from the care and attention bestowed upon the various processes, and from the admirable character of the seam of coal termed the Better Bed, differing from ordinary seams in its remarkable freedom from iron pyrites and other impurities. You may pass through the coking heaps or ovens without the least inconvenience from the sulphurous gases, which, in the coking of most coals, are so freely liberated."

Having extracted these few remarks from the memoir alluded to, I now proceed to point out the position occupied by this valuable seam of coal in the geological strata of the Bradford and Leeds districts.

The superficial seams of coal worked in the immediate neighbourhood of Leeds are unconnected with the manufacture of the iron. I will, therefore, confine myself to a mere enumeration of these various measures in the order in which they are to be found:—

1. The stone or cannel coal.
2. The Middleton bed.
3. The Beeston thin bed.
4. The Beeston thick bed.
5. The Crow coal.

Below the latter seam of coal we arrive at that portion of the strata especially connected with the manufacture of iron in the North Yorkshire district.

A section of this part of the strata gives the following results:—

1. Loose vein of sandstone, 9 to 18ft. thick.
2. Black bed ironstone, lying in a bed of shale, 3 to 4ft.
3. Black bed coal, 2ft.
4. Various measures of shale and stone. Roof of Better Bed coal, consisting of black shale with numerous fish remains, and small white nodules of ironstone, 120ft.
5. Better bed coal, 1 to 2ft. 6in.
6. Floor of indurated fireclay, 2 to 3ft.

From this portion of the strata, comprised within the short space of 40 yards, the materials employed in the manufacture of the iron are derived. The black-bed ironstone furnishes the ore. The Better Bed coal the fuel. The black bed is used for the engines, and from the valuable bed of fireclay are made the bricks and blast furnace linings.

The ironstone occurs in detached nodules of various sizes, deposited in five distinct layers, which are designated as follows:—Top balls, flatstone, upper rough measure, middle balls, lower rough measure (small ragged pits).

The superposition of these different measures is apt to vary. In some localities their course is difficult to trace in the surrounding shale. In others, where the seam is termed good, they appear to have been deposited with the most remarkable regularity, and to have remained undisturbed in the same state which had been assigned to them at the first formation of the strata.

In the last case the ore is worked with greater economy, and yields a larger quantity of stone per acre. 1,000 tons per acre is about the average yield at Farnley.

The fracture of this stone shows a blackish-grey tint, and yields by analysis:—

Metallic Iron	39·4 per cent.
Silica and Alumina	14·9 ,, ,,
Sulphur	·8 ,, ,,
Oxygen, Carbonic Acid, &c.	44·9 ,, ,,
	100·0

Although it would appear from this analysis, compared with the analysis of other ores in the kingdom, that there are no peculiar properties connected with the ironstone of this district, either as regards quantity or quality, to account for the excellence of the iron produced, it is, however, worthy of remark that a singular affinity or kindliness seems to exist between the ore and the Better Bed coal. The result of trials with other ores have been anything but satisfactory.

We now come to examine the fuel employed, and the first point that strikes us in burning a piece of Better Bed coal is its freedom from sulphur.

It is a well-known fact that sulphur is one of the chief obstacles in the manufacture of iron in this country. A very small proportion of this element entering into the composition of the iron will cause the latter to be brittle, and thereby render it unfit for purposes where great strength and toughness are required.

It is to the absence of sulphur that charcoal iron owes its pre-eminence. Hence the superiority of Russian and Swedish irons, and, in general, most irons manufactured with charcoal. The Better Bed coal (in its freedom from sulphur) is, I believe, of all the coals in the United Kingdom, the one which approaches the nearest to charcoal.

I have had one sample of this coal analysed lately by Mr. Wood, of this town, and the following are the results:—

Carbon	74·700
Hydrogen	5·000
Sulphur	·196
Ash	4·700
Oxygen and Nitrogen	15·404
	100·000

Other analyses will have to be be repeated on different samples of this coal before the average amount of sulphur can be determined with precision.

This first essay, however, is satisfactory, inasmuch as it places the Better Bed coal of this district in the foremost rank amongst the pure coals of England, and it is (as has been stated in the memoir alluded to in the commencement) to its exclusive use as a fuel, that the good quality of the iron manufactured at Lowmoor, Bowling, and Farnley is mainly attributable.

It is not my intention, sir, to take up your valuable time by entering into the details connected with the manufacture of iron in this district, although much could be said on this subject, for much has been done. My object, however, is to bring before your notice two points of importance in connection with the process of refining the pig metal at the Farnley Iron Works, and which are peculiar to that establishment.

The first has reference to the introduction of steam into the refinery along with the blast. The results hitherto obtained by the adoption of this process are satisfactory, inasmuch as the quality of the iron has been improved; especially with regard to boiler plate.

The second point to which I desire to call your atten-

tion, is the introduction of steel into the refineries in conjunction with the pig metal.

Converted bars of steel in various proportions are melted in the refinery along with the pig. A perfect mixture is thus obtained, and the refined metal produced presents a pure silvery fracture and a perfectly homogeneous texture.

The metal thus obtained is worked with much greater facility in the puddling furnaces. A puddler operating on ordinary metal, works up 9 heats (300 lbs.) in his turn of 12 hours; whereas, with refined metal, composed of two parts pig and one part steel, he can get through 12 heats in the same time.

The stampings and lumps are then taken through the ordinary processes, and the finished iron obtained from this metal is, to all appearances, of a very superior quality. It welds and punches remarkably well, and its fracture presents a very fine close grain.

It would be premature on my part to make any comparison between the quality of this "steel iron" and that of the ordinary iron of the district, until proper and well-conducted trials have been made with respect to their strength and durability.

Messrs. Kitson and Co., of this town, have undertaken to test the boiler plate and bar iron, and two sets of locomotive tyres are now running on the London and North Western line, and Mr. McConnell has promised to give an account of the manner in which they have worn.

SUBMARINE ELECTRIC TELEGRAPH.

Mr. Henley, of Greenwich, has completed a submarine cable of 240 miles to connect the island of Tasmania with Victoria, Australia. It will be laid from Cape Otway, Victoria, to King's Island, Bass's Straits, from King's Island to the River Mersey, and from the Mersey to Georgetown Heads, the entrance to the port of Launceston, Tasmania. The conductor is covered with gutta percha, and the gutta percha serving with Russian hemp, saturated with a mixture of Stockholm tar, linseed oil, and Russian tallow. The outer covering spun round this serving of hemp consists of 10 solid iron wires. The weight of the cable is two tons to the statute mile.

SOUTH KENSINGTON MUSEUM.

During the week ending October 23, 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,078; on Monday and Tuesday (free evenings), 2,006. On the three Students' days (admission to the public 6d.), 614; one Students' evening, Wednesday, 142. Total, 4,840. From the opening of the Museum, 646,460.

Home Correspondence.

THE LATE THOMAS TREDGOLD.

Dear Sir,—The enclosed letter from the late eminent engineer, Mr. Tredgold, to a deceased friend of mine, possesses points of interest which may perhaps be acceptable to the readers of our *Journal*. If you also think so, it is quite at your service.—I am, &c.,

THOS. WINKWORTH.

Gresham Club, Oct. 18, 1858.

16, Grove-place, Lisson-grove, Feb. 16, 1828.

Dear Sir,—Algebra is to mechanics what money is to mercantile people; it enables one in small compass to keep the debtor and creditor account between power and resistance, the final equation is the balance sheet of the transaction; but, unfortunately, if either of these be shown to men in certain states of society they are considered of no value; in another state, the value of the balance sheet has become known, and seeing that certain crooked and straight lines marked on a sheet of paper may represent the state of a man's concerns with admirable certainty, there is room for conjecture that the crooked lines of algebra may be equally certain and valuable; but that value has no measure, because a man cannot measure the value of that he doth not comprehend; but, in such a case, he has some idea of encouraging the thing, and watching the progress of its fruits; and, verily, I would have no great objection to the schoolmaster of Neath being occasionally called into request, and do most earnestly recommend that it be done when occasion renders it desirable. I, however, knew that ancient habits and methods are not easily changed; and, therefore, reduced all the rules that would easily bear it to words at length, with easy examples, and think that any person knowing the common rules of arithmetic may calculate all the proportions of the parts of the engines usually made; but, for fear this should not be so, there are two tables of the proportions for all power from 1 to 200 horses' power of double acting engines, and from 10 to 200 horses' power for single engines. Again, if any difficulty should arise, I am within the reach of the post, and, further, would willingly add Mr. Vigurs' name to the list of my correspondents. The best thing would be for Mr. Vigurs to get the book,* make choice of the kind of engine, settle the power, or state the duty he wished it to perform, and then give me an order for a set of working drawings to execute it by; the expense of which would be at the rate of 3½ per cent on the cost of the engine, and he should estimate the cost at his own rate, provided he does not get it below £20 per horse power for a 10 horses' power engine. I have made two sets of drawings for steam-engines this year, and I am happy to find that more people begin to make use of this simple and cheap means of having the ideas of a person who has devoted his life to such subjects, and has given the world samples at large to choose out of. Five per cent. is given for the plans of a house, but an engine it is much more important should be good, for otherwise it may be a source of hourly loss.

If you will be so good as to notice the parts which apply to the case and to the man, and select those which will have the most weight in determining him to have a set of drawings as well as the book, you will serve both him and me.

As a sample of the march of intellect, suppose old Robert Recorde, the first English writer on arithmetic, endeavouring to teach a merchant the use of that art, whose mind is occupied in ascertaining its advantage over the notches of his tally sticks, half inclined to think the latter the best. Set the painter to work, and exhibit at the R. Exchange for the benefit of the Robert Recordes of the day.

It is chiefly owing to being opposed to Mr. H's doctrines in some points that I have not followed the subject (of Political Economy) up so closely as I intended; there is a certain degree of not-meddling with trade which it appears to me is most desirable, but it appears equally so that when a large proportion of a population are embarked in a particular kind of trade, they should be protected from the competition of foreigners in the home market, and particularly when the commodity is one of the necessaries of life; the degree of protection to be such as barely saves the home producer, that he may be induced to turn to some new line of production, for the population must either produce new articles to be equivalent to the foreign goods, or they had better continue to produce the old articles. One state is as one firm—the good of the whole is the object.

Consider this point against I have the pleasure of seeing you.

I am, dear Sir,

Your most obedient servant,

THOMAS TREDGOLD.

To John Vigurs, Esq., Cwm Avon.

* It would be worth his while to see the book, to consider how far the new methods proposed to render the engines more simple and effective, can be adopted so as to render him successful as an engine-maker of the first rank; he having the advantage of easy access to the scientific and draftsmen's parts, might render his works a rival of Soho.

WATER POWER.

Sir,—As you have been pleased to notice the paper I read at Leeds, on "The Economy of Water Power," permit me to send you a short account of an elegant and useful application of water pressure I saw at work there.

The Town-hall of Leeds contains a powerful organ, which is blown by the pressure of water from the main pipes that supply the town. A branch pipe, fitted with a regulating tap, conveys the water to the organ, where its pressure, acting against the piston of a small cylinder,

like that of a steam-engine, produces a reciprocating motion, which blows the bellows.

As the air-chest fills, a lever attached to it acts upon the regulating tap before mentioned, and lessens the supply of water, so that the piston goes more slowly, but, as the organist requires more wind, and the air-chest falls, the regulating tap is opened, the action of the piston becomes more energetic, and the supply of air keeps pace with the demand, so that the organ is much more evenly blown by the machinery than it can be by men working the bellows.

This is but a brief outline description of the apparatus, for there are several ingenious contrivances about it which have been found requisite to ensure its success in practice, and they do great credit to the mechanical skill of Messrs. Joy and Holt, of Leeds, who have taken a patent for their application of water power to this purpose.

A smaller organ, suitable for a drawing-room, also blown by water pressure applied in the same way, was in use at the Leeds Exhibition of Local Industry during the meeting of the British Association, and a sectional model of the apparatus was placed beside the organ.

I need not enumerate the great advantages of having motive-power always ready to blow an organ, so that the player has merely to turn it on, as it were, by drawing a stop. A lady, an amateur, an invalid, or even a professional organist, may practice or amuse themselves when they please to do so without the help of an organ blower, if the instrument be large, or without blowing by the foot of the performer, as is usual in smaller organs.

Many attempts have been made to apply mechanical power to blow organs, and, in some cases, water-power has been tried. The writer remembers, many years ago, a lady who was an excellent performer, and had a large instrument in her house requiring a man to blow it, until her husband, who was an engineer, had a small water-wheel placed outside of the house, which could at any time be put in action by drawing a stop attached to the sluice, and so turning on the water, when a crank fixed upon the axis of the water-wheel worked the bellows; but, in this case, the action was uniform and constant, unless the performer varied it by regulating the quantity of water with the sluices, whereas in the Leeds organs this regulation is effected by the machine itself, without care or thought on the part of the player, and with such a degree of apparent adaptation to the performance exhibited in the movements of the machine, that it seems to know what to do and when to do it.

I may add that the apparatus is not costly, and that the expense of water is not equal to a labourer's wages, where a pressure of only ten pounds on the square inch can be obtained. I am, &c.,

JOSEPH GLYNN.

28, Westbourne-park-villas, London, W.,
October 25, 1858.

Proceedings of Institutions.

Banbury.—The half-yearly meeting of the Mechanics' Institute was held on Wednesday, the 29th Sept., Mr. Brooks in the chair. The reports for the last half-year were read and unanimously adopted. They were of a highly satisfactory and encouraging nature. The general report, read by the secretary, states that a great improvement has taken place in the monetary condition of the Institution, and the committee hope to be able to add very considerably to the library during the coming half-year. Since the last meeting a musical soirée has been held in the town hall, when several gentlemen and ladies gave their gratuitous assistance. On the 23rd of June the annual pic-nic was held, by the kind permission of G. G. Harcourt, Esq., M.P., in the grounds of Nuneham; and about 400 of the members and their friends availed themselves of the excursion. In addition to the enjoyment of a very pleasant day, the funds of the Institution were increased by the sum of £10 12s. The following are the lectures arranged for the present season:—Basil Young, "On the Life of George Stephenson;" Lizzy Stuart, "On the Ploughman Poet," a musical entertainment; J. Bennett, F.R.A.S., "On the Watch;" George Dawson, M.A., "On Daniel Defoe;" Mrs. Bessie Inglis, "On the Influence of Woman on Society;" George Grossmith, "On Pickwick;" The Rev. J. J. Brown, "On the Natural History of a Book;" J. Wild, "On Music;" F. Warren, C.E., "On the Education of the Workman and his Work—the result of both." The Committee, with a view to promote the convenience of the entire body of the members, have determined that all the lectures shall be delivered at the town hall, in order that the reading-room and library may remain open for the benefit of those who do not wish to attend the lectures. The lecture on the Life of George Stephenson was not well attended, but Miss Lizzy Stuart's musical entertainment was very successful, and the committee are pleased at being able to state that in consequence no loss has as yet been sustained on the lectures. The committee report the promise of a subscription of £10, by B. Samuelson, Esq., towards the lecture fund. The sum of £10 was awarded to the Institution by the Society of Arts for the success of its candidates at the last Examination; and it has been determined (with the view to promote the education of the members) to devote it towards paying one-half the cost of members of the Institute attending the classes.—Mr. Gibbs moved the adoption of the report, in so doing briefly referring to the satisfactory condition, more especially financially, of the Institution, which, instead of being in debt, would have a balance of £49 7s. 4½d. to its credit, when the various amounts due on account of members' subscriptions, &c., were paid in.—Mr. Boss then read his report as librarian, from which it appears that the present number of members is 204. The following classification of them shows that, to a certain extent, the Institution has the support of all classes:—1 peer; 1 member of parliament; 1 clergyman; 3 magistrates; 6 bankers; 7 professional gentlemen; 9 schoolmasters, mistresses, and teachers; 48 tradesmen; 36 clerks, 41 tradesmen's assistants; 31 mechanics; 20 without any particular calling, youths, &c. The number of books issued from the library during the past half-year is 1,875, making more than 4,000 circulated in the year. There has been a greater demand for books of an elementary and scientific character than is usual, during the last few weeks. 19 new members have already entered the Institution in this, the Michaelmas quarter.—The election of officers then took place, and the proceedings terminated by votes of thanks to the librarian, the secretary, and treasurer, which those gentlemen respectively briefly acknowledged.

London Mechanics' Institution.—Lord Murray has written to Mr. T. J. Pearsall, the corresponding secretary, expressing his concern that the parent Mechanics' Institution of England should be in need of extraneous assistance, and enclosing a draft for £100 in aid of a fund for purchasing the lease of the building, and thus extinguishing the heavy annual charge for rent. The total amount to effect this desirable object is £3,500. The subscriptions from private sources amount to about £400, and a public appeal is shortly to be made.

Manchester Athenæum.—A soirée, composed of the members and friends of the Manchester Athenæum, took place on Thursday evening, the 21st October, in the Free Trade-hall, at which more than 2,000 were present. Among the guests present on this occasion were Lord Stanley of Alderley (who presided), Lord J. Russell, the Hon. Judge Haliburton, Professor Aytoun, Sir James Brooke, Mr. Monckton Milnes, M.P., Mr. W. M. Massey, M.P., Mr. James Kershaw, M.P., Mr. William Brown, M.P., Mr. John Cheetham, M.P., Mr. J. P. Brown-Westhead, M.P., Mr. James Grant, of Edinburgh, Mr. G.

Cruikshank, &c. The following gentlemen were upon or near the platform:—Admiral Smyth, Cols. Wilbraham, M'Mahon, Bond, Servante, Hodges, Kennedy; Mr. Ivie Mackie, Mayor of Manchester; Mr. W. Harvey, Mayor of Salford; Rev. Dr. Petrulias, Alderman Sir Elkanah Armitage, president of the Institution; Sir James Watts, Neild, Watkins, Willert, Clark, Heywood; Mr. Thomas Wright, "the prison philanthropist;" William Fairbairn, F.R.S., Thomas Bazley, Oliver Heywood, Samuel Brooks, Malcolm Ross, A. Schwabe, H. P. Rée, John Reid, W. R. Wood, Thomas Clegg, Thomas Barge, jun., James Crossley, Joseph Heron, the Belgian Consul (Mr. Kissel), the Very Rev. the Dean of Manchester, the Hon. and Rev. Mr. Byng, the Rev. Mr. Birch, the Mayor of Ashton, Sir James L. Bardsley, M.D., Lieut. Sturt, Messrs. Joseph Adshead, C. J. S. Walker, Capt. Palin, Messrs. J. D. Mackenzie, C. Swallow, W. W. Goulden, R. P. Willock, Isaac Gregory, and Dr. Hudson, the secretary of the Institution.—The Chairman said that the Manchester Athenæum was the first association of the kind which recognised the propriety of educating the people by means of attractive literature, by consulting their tastes and interests, and not by cramming philosophy and hard sciences into them; and by providing them with good and useful books, and above all with newspapers. It had long been found necessary by Mechanics' Institutions to speak to men rather through their feelings and tastes than to compel them to be too wise all of a sudden. It had struck him that there was great justice in the remarks of Mr. Sotheron-Estcourt, who, referring to the lamentations of many people upon the difficulty of keeping boys at school until they could obtain complete instruction, said he felt that it was a great evil to compel them to attend school beyond the time for which their circumstances allowed them to stay. Mr. Sotheron-Estcourt stated that he had made a successful experiment with such boys. During the wars in the Crimea and in India he had invited the boys in his parish to meet him, either to hear a short lecture, or to listen to the reading from a newspaper, by one of their own number, of an account of the proceedings at the seat of war. By that means he induced them voluntarily to continue their studies; and by degrees they expressed a greater anxiety to instruct themselves. The chairman then made some general remarks on the advantages of education and of the spread of cheap literature, and concluded by introducing Lord John Russell to the meeting.—Lord John Russell, after expressing his surprise that some attacks had been made upon him in a local newspaper of large circulation, for having accepted the invitation to be present on this occasion, said that one of the principal benefits derived from such meetings as the present was, that persons from different parts of the country, and persons engaged in different situations in life—some political, some literary, some industrial—were induced to meet together and to express good-will and fellowship towards each other. We had in this country a great deal of attachment to our private life. We boasted of our affection for our homes very justly, but we had not the public life which was common in some ancient republics, nor that sort of public life which he understood now existed in some of the United States of America. And the more we were attached to private life, the more necessary it appeared that we should now and then mingle together and exchange good wishes. In considering the purposes of the Institution which they came there to support, he found, in the first place, that newspapers were read, next that books are taken out very largely from the library and perused by the members. With regard to newspapers, it was quite obvious that there must always be a great interest attached to the matter contained in them, and, with regard to the library, he found that, of about 28,000 books taken out to read, there were above 17,000, or near 18,000 of novels, and about 10,000 of works of history and of all other descriptions. He thought this was a very creditable account. So far from being shocked at the quantity of novels that were read, he really did not wonder that men who had occupations that gave them a great deal of care and anxiety should resort to those delightful fictions which went by the name of novels, and that they should seek in those pages relaxation after their harrassing employments. So, looking at another institution, the free library of that town, there were about 40,000 novels to about 23,000 books of other descriptions—a somewhat similar proportion, and one which he thought did great credit to the readers, because it showed that there was a very fair proportion—upwards of one third—who did read books of an informing and instructive kind. What then would be the effect of all this increase of knowledge and instruction? He could not but believe that it would make the persons who possessed it happier, and the institutions of the country safer than they were before. If a man could abstract his attention, for a portion of the day, from the care and anxieties of his ordinary occupation, and could look into the past, or be interested in some tale, or, still more, be raised by the sublime songs of our poets, much he thought was gained for the elevation of his moral nature and the happiness of his daily existence. It was characteristic of the political institutions of this country, that while the fullest protection was given to life and property, there was at the same time the greatest liberty of opinion—the utmost power given to every one to express his opinions—to form any opinion that he chose, and to express that which he thought. If that was the case, it gave an additional importance to all these societies for literature, for education, and for improvement; because it gave to every man the means, if he had the wish and the ambition, and the talent, of rising in the society to which he belonged. If such was the spirit of our institutions, it was of great importance not only to us but to the world in general, that we should hold on steadily in our course. We had, as had been said long ago, "a precedence in teaching the nations how to live." That precedence was not to be maintained by any carelessness, by any ignorance, or by any precipitation, but by the people of this country being thoroughly and well informed, weighing what they are about to do, taking counsel from the lessons of others, and examining their laws with a critical, but not with a prejudiced or unfriendly eye. Believing in the high character of this people, in their natural good sense, he delighted in every occasion in which he saw that the knowledge of the people of this country, and with their knowledge their power, was making advance. After referring to the statue of Mr. Joseph Brotherton, M.P., and the great private and public usefulness of that gentleman, as a proof of the kind of man whom Manchester loved to honour, his lordship concluded by saying that he believed increase of knowledge would bring with it increase of veneration; and that the more we knew, the more we should bow to the wonderful works of Almighty wisdom.—Professor Aytoun, after some introductory remarks, said he had lately arrived at the conclusion that while people elsewhere had been talking vaguely, and, in some cases, foolishly, upon the subject of education, Manchester had been quietly doing everything. He believed the Free Library in Manchester to be unequalled in the world; and he found that, having been in operation for a considerable period, it now furnished precisely the data which statesmen and philanthropists had been for a long time attempting to find out—namely, what was the kind of reading that ought to be given to the people. Why, of course, the kind of reading to be given to the people was that kind which the people would accept. He found that the standard works of imagination were those most in favour with the people, and he thought it a great mistake to expect that all working men should be made scientific philosophers. Let the people be only taught to read; give them the power of understanding; give them libraries, as Manchester had done, and they would have given

to the mechanic the basis of his own education, and have placed it within his power. He was extremely glad to see, from the report, that the evening classes had been cultivated to a great extent—classes in French, German, chemistry, and several other branches of popular learning —attended by young men who only had leisure during the evening. But he was disappointed that the system of lectures had been discontinued in the Athenæum. He knew that many objected to them as superficial things, on the ground that those who attended three or four lectures could merely acquire a smattering of a subject. That was undoubtedly true at present. But the great thing was to get men who could well handle their subjects, and who should select such subjects as would be of real interest to the community, and yet not too deep or too affected. Professor Aytoun concluded by advocating oral teaching, and especially the reading aloud to large audiences of great works of imagination. The meeting was then addressed by the Hon. Judge HALIBURTON, Sir JAMES BROOKE, K.C.B., Mr. MONCKTON MILNES, M.P., and Mr. GEORGE CRUIKSHANK. On the motion of Mr. J. CHEETHAM, M.P., seconded by Mr. J. P. BROWN-WESTHEAD, M.P., a vote of thanks was passed to Lord John Russell for his attendance and address; and a similar compliment was paid to the chairman for presiding, on the motion of Mr. JAMES CROSSLEY, seconded by Mr. MALCOLM ROSS. The proceedings then terminated.

MEETINGS FOR THE ENSUING WEEK.

MON. ......British Architects, 8. Mr. W. Tite, "Observations on the recent discoveries of the remains of the Mausoleum at Helicarnassus."

WED. ......Geological, 8. I. Rev. O. Fisher, "On some natural Pits in the Tertiary Lands of Dorsetshire." II. Dr. Rubidge, "On some points in the Geology of South Africa." III. Mr. W. Stow, "On some Fossils from South Africa." IV. Mr. N. T. Wetherell, "On some of the Siliceous Nodules of the Chalk."

THURS. ....Linnæan, 8. Mr. George Bentham, "Notes on British Botany."
Zoological, 3.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 22, 1858.]

Dated 30th June, 1858.

1472. B. Nicoll, 42, Regent-circus—Imp. in circular knives and saws.

Dated 16th August, 1858.

1870. P. Richard, 17, Rue St. Jean, Faubourg St. Germain, Paris—Imp. in apparatus for obtaining motive power.

Dated 25th August, 1858.

1928. J. Dredge, Walcot, Bath—Imp. in condensers for steam engines, and in pumps for working such condensers, or for lifting water from deep mines, and for any other use to which pumps are applicable.

Dated 26th August, 1858.

1936. G. M. Sautter, 14, Boulevart Montmartre, Paris—Imp. in telegraphs. (A com.)

Dated 10th September, 1858.

2050. J. L. Chester, Philadelphia, U.S.—Imp. in self-priming apparatus for fire-arms, and in the preparation of percussion primers to be used therewith. (Partly a com.)

2054. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in Jacquard machines. (A com.)

Dated 11th September, 1858.

2062. W. Baker, Kingston-upon-Hull—Imp. in preparing food.

2064. J. M. Courtauld, Braintree, Essex—An imp. in clearing and preparing silk crapes, aerophanes and other like fabrics, lisses and other gauzes and lace, and in machinery employed therein.

Dated 13th September, 1858.

2076. R. Frost, Steam Mills, and A. Rigg, Park-gate-road, Chester—Imp. in apparatus for cleaning grain or seeds and bran.

Dated 14th September, 1858.

2084. W. J. Hoyle, Huddersfield, and R. Howson, Lancaster—Imp. in arrangements and mechanism, or apparatus for signalling by sound.

Dated 18th September, 1858.

2104. G. Ostermoor, 37, Basinghall-street—Ornamenting boas, victorines, and muffs.

Dated 20th September, 1858.

2112. J. L. Chester, Philadelphia, U.S.—An improved cartridge opener and ramrod fastener. (Partly a com.)

Dated 24th September, 1858.

2144. E. T. Wright, Wolverhampton—A new or improved method of, and apparatus for, preventing the explosion of or injury to steam boilers through deficiency of water.

Dated 25th September, 1858.

5152. A. F. Delacroix, Chartres, France—Imp. in locomotive engines.

2156. C. Hall, Navestock, Essex—Imp. in apparatus for applying power to the cultivation of the soil.

2158. J. C. Dieulafait, 2, Rue Sainte Appoline, Paris—A kind of garment which may receive different forms according to the will of the wearer.

Dated 28th September, 1858.

2164. E. Lewthwaite, Halifax, and G. Ambler, Queen's Head, near Halifax—Imp. in clocks, watches, chronometers, and other timepieces.

2166. J. H. Linsey, 4, Grocers' Hall-court—Certain imp. in binding or covering books.

2168. J. L. Clark, Adelaide-road, Haverstock-hill—Imp. in coiling and securing telegraph cables preparatory to laying them from ships or vessels.

Dated 29th September, 1858.

2170. J. Luis, 1B, Welbeck-street, Cavendish-square—A new method of fixing pastel pictures. (A com.)

Dated 30th September, 1858.

2174. J. Wright, Birmingham—Certain imp. in the mode of arranging and moving fire-bars for locomotive, puddling, and other furnaces.

2176. S. Taylor, Rochdale, Lancashire—Certain imp. in apparatus to be used as a fire-escape, which improvements are also applicable to other similar purposes.

2178. H. Kinsey, W. H. Morrison, and S. Smithard, Nottingham—Imp. in means or apparatus for the purpose of folding lace or other fabric, and also for cutting the same into lengths adapted to be used in the manufacture of bonnet and cap fronts, and for other purposes of millinery.

2180. C. W. Siemens, John-street, Adelphi—Imp. in electric telegraphs. (Partly a com.)

2182. G. Uhlhorn, Grevenbroich, near Cologne, Prussia—Imp. in applying motive power to give motion to machinery.

2184. F. J. Money, Thaxted, Essex—Imp. in the construction and adaptation of sewers.

Dated 1st October, 1858.

5185. W. Blake, 16, Harley street—An improved portable fire-escape.

2186. J. T. P. Newbon and T. Smith, 62, Fenchurch-street, and J. Brown, 37, Tollit-street, Mile End—An improved method of lifting and lowering ships' anchors.

2187. M. Hipp, Berne, Switzerland—Imp. in electric telegraphs.

2188. J. W. Wilkins, Temple-chambers, Fleet-street, and J. B. Dunn, Great Winchester-street—Imp. in constructing electric telegraph cables.

2189. Sir E. Belcher, 40, Charing-cross—Imp. in the manufacture of telegraphic cables.

2191. H. Bradbury, Whitefriars—Imp. in producing printing surfaces from engraved plates.

Dated 2nd October, 1858.

2192. J. Rogers, 9, Queen-square, Bartholomew-close—Imp. in submarine electric telegraph cables.

2193. L. D. Owen, 192, Tottenham-court-road—Imp. in ploughs for digging up potatoes, and for other purposes. (A com.)

2194. W. Brierley, senr., Cleckheaton, Yorkshire—Imp. in looms for weaving carpets and other fabrics.

2195. H. Monier, 2, Francis-street, Golden-square—A new gas burner.

2196. B. Samuelson, Banbury—Imp. in the wheels of carts and other carriages to be used on common roads.

2197. H. G. Collins, Paternoster-row—Imp. in the production of blocks or surfaces to be used in printing.

2198. J. C. Holman, London-street, and E. W. Holman, Grafton-street, Fitzroy square—An improved pianoforte action.

2199. A. V. Newton, 66, Chancery-lane—An improved governor for marine and other steam engines. (A com.)

2200. S. Stimpson, Lower-road, Islington—An improved construction of fagot or fire lighter.

Dated 4th October, 1858.

2201. R. Dolby and J. Gates, Liverpool—An improved process of transfer printing, and ornamenting on glass and other transparent substances.

2202. L. A. Normandy, jun., 67, Judd-street—An improved apparatus for the prevention of boilers exploding from a deficiency of water. (A com.)

2203. L. A. Normandy, jun., 67, Judd-street—Imp. in the manufacture of sulphate of copper. (A com.)

2204. M. Van Peteghem, Ghent, Belgium—Imp. in looms for weaving figured fabrics. (A com.)

2205. F. Trevithick, Penzance, Cornwall—Imp. in applying sails and keels to boats and vessels.

Dated 5th October, 1858.

2206. J. Mills, Manchester—Certain imp. in machinery or apparatus for roving, slubbing, or spinning cotton and other fibrous materials.

2207. A. Bessemer, Upper Holloway—Imp. in the manufacture of iron and steel, and in apparatuses to be employed therein.

2208. Major C. E. Oldershaw, R.A., Aldershot—An improved method of constructing electric telegraph cables.

2209. W. Menelaus, Dowlais Iron Works, Glamorganshire—Imp. in machinery for straightening rails and wrought-iron bars.
2210. M. Henry, 84, Fleet-street—Imp. in the means of, or arrangements for, working steam expansively. (A com.)
2211. J. H. Brown, Abbey Mills, Romsey, Hants—Imp. in the manufacture of projectiles.
2212. G. Hamilton, St. Martin's-le Grand, and W. Nash, Poplar—Imp. in locks.
2213. J. H. Brown, Abbey Mills, Romsey, Hants—Imp. in the manufacture of cartridges.
2214. J. Milnes, Sutton Mill, Cross Hills, near Leeds, Yorkshire—Imp. in weaving fabrics where cross weaving is employed.
2215. G. Lovett, East street, Manchester-square—Imp. in portable apparatus for administering hot air, vapour, and shower baths.
2216. M. Jacoby and F. R. Ensor, Nottingham—Imp. in the manufacture of bobbin-net or twist lace, and other fabrics made in twist lace machines.

Dated 6th October, 1858.

2217. J. Luis, 1b, Welbeck-street, Cavendish-square—A new method of joining sheet-iron, cast-iron, gutta-percha, and other tubes, by means of muffles. (A com.)
2218. G. Heppell, Newcastle-on-Tyne—Imp. in the construction of boilers, furnaces, and flues.
2219. G. Collier, Halifax—Imp. in winding machines.
2220. M. Harnett, Moreton-street, Pimlico—Imp. in preventing incrustation in steam-boilers. (A com.)
2221. C. Hill, Great Western Railway, Chippenham Station—Imp. in omnibuses and in apparatus for upholding the windows of omnibuses and other carriages.
222. J. Ridsdale, Stoke Newington—An improved reservoir or fountain pen.
2223. W. Malam, Clapham-road, Surrey—Imp. in apparatuses for the manufacture of gas.
2224. D. Scattergood and R. W. Smith, Nottingham—Imp. in machinery for the manufacture of looped fabrics.
2225. C. Baylis, Poultry, London—An improved mode of constructing and arranging underground chambers in populous cities or towns, for the reception of gas and water pipes, and telegraph wires.

Dated 7th October, 1858.

2226. D. Nicoll, 114, Regent-street—Imp. in the manufacture of cloaks and other garments, and for their application to purposes to which they have not hitherto been applied.
2227. C. H. Thurnbam, Dalston—Imp. in the construction and application of certain mechanical arrangements to be adapted to the wheels of locomotives, carriages, and other vehicles for facilitating their traction or draught.
2228. E. J. Seyd, and J. W. N. Brewer, City of London—An imp. in the preparation of paper to render writing thereon indelible.
2229. J. C. Nouveau, 2, Rue Sainte-Appoline, Paris—Imp. in stopping or stoppering bottles and other vessels containing non-gaseous liquids.
2230. D. Naylor, Stockport—Imp. in looms for weaving carpets and other fabrics, and in the methods of manufacturing the same.
2231. N. Fellows, jun., West Derby, Lancashire—Imp. in tea kettles and other like domestic vessels.
2232. F. Ransome, Ipswich—Imp. in preserving wood.
2233. E. R. Handcock, 57, Pall-mall, Westminster—Certain imp. in machinery applicable to engines to be worked by steam and other motive power.

Dated 8th October, 1858.

2234. J. Luis, 1b, Welbeck-street, Cavendish-square—A new cutting and stamping press. (A com.)
2235. J. Leetch, Margaret street, Cavendish-square—An improved method of constructing fire-arms.
2237. T. Waller, Rose lane, Ratcliff—Imp. in stoves and fire places for the prevention of smoke and the better ventilation of apartments.
2238. J. Mitchell, H. Mitchell, and T. England, Bradford—Imp. in means, machinery, or apparatus employed in spinning wool, mohair, alpaca, silk, and other fibrous substances.
2239. R. Searle, Woodford Wells, Essex—Imp. in insulating and preserving and laying submarine and other telegraphic wires or cables.
2240. A. Nicholls, Manchester, and T. Walker, Birmingham—An improved spring-hook, catch, or fastening.
2241. W. A. Munn, Throwley-house, near Feversham, Kent—Imp. in horse-hoes.
2242. T. Roberts and J. Dale, Manchester—An improved process for obtaining salts of soda and other alkalies.
2243. C. W. Lancaster, New Bond-street—A metal or metallic alloy especially adapted to the manufacture of fire arms and ordnance.
2244. A. Felton, 184, Brick-lane, Spitalfields—Imp. in instruments used for inserting and fixing metal eyelets.
2245. J. T. Smith, Gray's-inn—Imp. in electric cables.
2246. E. Birchley, Upper Severn-terrace, Worcester—An improved construction of cartridge.
2247. F. W. Gerhard, Tichborne-street, Haymarket—Imp. in the manufacture of aluminium and sodium.

Dated 9th October, 1858.

2248. A. E. Galliard, 2, Seymour-place, St. James Churchyard, Clerkenwell—Making self-supplying portable fountains to play water or water perfumed.
2250. J. Tatlock, Hookersbrook, near Chester—Imp. in electric telegraphs, and in telegraphic cables or conductors for the conducting of electricity in submarine and underground telegraphs.
2251. L. Hope, Bishopsgate Churchyard—Imp. in electric telegraph cables. (A com.)
2252. W. Crofts, Lenton-terrace, Park Side, Nottingham—Imp. in the manufacture of fabrics by bobbin-net or twist-lace machinery.
2253. J. B. Pascoe and J. R. Thomas, Chacewater, Cornwall—Imp. in condensing and gassing smoke, which are applicable also to forcing and drawing water, propelling ships, and drawing and forcing air to be worked with animal, water, steam, or air power.
2254. J. Scrimshaw, 13, Johnson-street, Sheffield—Imp. in pumps.

Dated 11th October, 1858.

2255. A. Miller, Glasgow—Imp. in locomotive steam engines. (A com.)
2256. J. Holroyd, Leeds—An imp. in the knives used for shearing woollen cloths, and cloths made of wool and other materials.
2257. C. F. Vasserot, 45, Essex-street, Strand—Imp. in constructing reflectors. (A com.)
2259. J. Beattie, Lawn-place, South Lambeth—Imp. in locomotive and other steam engines.
2261. J. L. Hancock and F. L. Hancock, Pentonville—Imp. in implements for tilling, breaking up, or pulverising land, for sowing seeds, and for thinning out turnips and other crops.
2262. J. England, Charles-street, Fitzroy-square—Imp. in apparatus for cleaning the plates used in photography.
2263. J. Platt, Audlem, Chester—Imp. in locks.
2264. J. Nicholson, junr., Meadow-street Works, Sheffield—Imp. in machinery for cutting and winding strips or shreds of steel, silver, or other metal used for ladies' dresses, measuring tapes, and other purposes, in which the use of strips or shreds of metal are required.
2266. T. Riddell, Carocou-terrace, Old Ford, Bow—An improved arrangement for sustaining window sashes and sliding panels.
2267. M. Stow, Leeds—Preventing or securing the detection of alterations or erasures in bankers' cheques and other similar instruments, and the crossings thereof.
2268. W. E. Newton, 66, Chancery-lane—Improved apparatus for facilitating submarine explorations. (A com.)

Dated 12th October, 1858.

2272. W. Johnston and W. Ross, Glasgow—Imp. in water-closets and taps or valves.
2274. Capt. G. Beadon, R.N., Bathpool, Somerset—Imp. in the construction of ships, boats, rafts, and vessels for passing through water, or through the atmosphere, or partly through the water and partly through the atmosphere.
2276. H. W. Cuthbertson and G. Cuthbertson, Dundas-street, Monkwearmouth, Sunderland—Imp. in lever purchases for ships, windlasses, pumps, and other similar purposes.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Oct.* 26, 1858.]

October 26th.

917. W. Jones.
920. J. Seaman.
921. W. Foster.
922. E. E. Lee.
928. C. F. Vasserot.
932. B. Drukker.
938. D. E. Hughes.
943. B. Martin and C. J. Light.
949. A. Winkler.
954. A. M. Perkins.
955. C. Lawrence.
957. W. Smith.
958. W. Smith.
968. G. H. Ellis.
975. R. Wardell.
981. J. A. Hartmann.
985. J. Taylor.
995. W. Ross.
1002. D. E. Hughes.
1023. J. M. Duvard.
1044. J. M. E. Masson.
1050. G. H. Creswell.
1101. H. Curzon, jun.
1130. J. C. Brant.
1169. G. Alton and J. Fernie.
1190. J. Schofield and G. Harling.
1295. A. Rigg, sen., and A. Rigg, jun.
1547. J. Broadley.
1632. J. Chadwick.
1816. W. Spence.
1834. G. Houghton.
1861. C. O'Neill.
1898. W. Clay and E. L. Benzon.
1906. C. De Jongh.
1914. A. Boyle.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Oct.* 22, 1858.]

October 18th.

2342. W. Tatham.
2343. W. A. Gilbee.
2372. W. Shears.
2414. W. Hartley.

October 19th.

2353. N. S. Dodge.
2377. J. Rives.

October 20th.

2392. T. B. Sharp & R. Furnival.
2484. T. Thomas.

[*From Gazette, Oct.* 26, 1858.]

October 21st.

2375. J. Smith.

October 22nd.

2390. S. O'Regan.

October 23rd.

2385. E. H. Rascol.
2404. J. Hands.
2410. J. Whitworth.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 5, 1858.

NOTICE TO MEMBERS.

The One-Hundred-and-Fifth Session of the Society will commence on Wednesday, the 17th inst. The Chair will be taken at 8 o'clock on the following Wednesday Evenings :—

1858.	November.........	—	—	17	24	—
,,	December	1	8	15	22	—
1859.	January...........	—	—	19	26	—
,,	February	2	9	16	23	—
,,	March	2	9	16	23	30
,,	April...............	6	13	—	27	—
,,	May.................	4	11	18	25	—
,,	June................	—	—	—	—	29*

For the Meetings previous to Christmas, the following arrangements have been made :—

November 17.—Introductory Address on the Opening of the One-Hundred-and-Fifth Session, by the Chairman of the Council, Mr. C. WENTWORTH DILKE.

*** On this evening the Medals which were awarded by the Council for Papers read at the Weekly Evening Meetings during the last Session, and for articles submitted to the Society's Committees, will be distributed.

November 24.—Mr. F. JOUBERT. "On a Method of rendering Engraved Copper-Plates capable of Producing a greatly-increased Number of Impressions."

December 1.—Mr. HYDE CLARKE. "On Copper-Smelting."

December 8.—Mr. P. A. HALKETT. "On Guideway Agriculture ; being a System enabling all the Operations of the Farm to be performed by Steam Power."

December 15.—Mr. E. J. REED. "On the Modifications which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence."

December 22.—Dr. FORBES WATSON. "On the Growth of Cotton in India."

* The Annual General Meeting: the Chair will be taken at 4 o'clock. No Visitors are admitted to this Meeting.

LITERARY AND ARTISTIC COPYRIGHT.

Formerly Belgians enjoyed the unenviable notoriety of being amongst the greatest freebooters of whom *alien* authors and artists had to complain. The piracy of foreign literary and artistic productions was then considered to be a perfectly legitimate branch of Belgian industry on the part of those who were interested in upholding so manifest an injustice. Happily the good sense and honesty of the Belgian nation at length prevailed, and in 1852 the Government commenced the termination of a state of things so disgraceful to the country, by entering into international treaties with foreign States for the mutual protection of Copyright works.

This noble reform so recently, yet happily commenced, has been further promoted by M. CHARLES FAIDER, formerly Minister of Justice, and a most distinguished advocate, together with a number of other Belgian gentlemen of high position and influence. These parties, actuated by motives which do them eternal honour, proposed and succeeded in forming a Congress at Brussels of distinguished men of all countries interested in the production of original literary and artistic works. A programme* of the subjects for discussion was issued, and persons and societies connected with Literature and Art were invited to assist at the meeting of the Congress if possible, and, if not, to state their views by letter to the secretary upon the subjects proposed for discussion.

The Congress was opened on the 27th September, under the presidence of M. Charles Faider. Upwards of 500 letters were received from private individuals and societies, expressing their approval of the objects of the Congress. About 250 persons attended at the meeting of the Congress, and took part in the proceedings. Germany, England, Belgium, Denmark, Spain, the United States, France, Italy, the Low Countries, Portugal, Russia, Sweden and Norway, and Switzerland, were all represented.

The members of the Congress were then divided into five committees, for the purpose of considering and debating the several subjects for their decision. All these committees, except the second, terminated their deliberations on the 27th Sept. Those of the second committee extended over all the four days during which the Congress continued, that is, to the 30th.

Each committee having made its report to the general meeting of the Congress, such reports were then read and discussed.

His Majesty the King of the Belgians and the Royal Princes took great interest in the objects of the Congress, honouring the meetings with their presence during the debates, and subsequently receiving the members at the palace. The following are the

"RESOLUTIONS PASSED BY THE CONGRESS.

I. *Questions relating to an international recognition of Literary and Artistic Property.*

1. The Congress considers that the principle of an international recognition of property in works of literature and art, in favour of their authors, ought to take a place in the legislation of all civilised nations.

2. This principle ought to be admitted from country to country, even in the absence of reciprocity.

3. Foreign authors ought to be placed upon exactly the same footing as native authors.

4. There is no reason for requiring foreign authors to conform to particular formalities in order to be qualified to claim the right of property. In order to obtain that right, it ought to be sufficient that they should have complied with the formalities required by the law of the country where the original publication first appeared.

5. It is desirable that all countries should adopt, for property in works of literature and art, a legislation resting upon a uniform basis.

II. *Questions relating to property in works of Literature and Art in general.*

1. Authors of works of literature and art ought to enjoy, during their whole life, the exclusive right of publishing and reproducing their works, of selling them, of causing them to be sold or distributing them, and of giving up altogether or partially their property in them, or their right of reproduction.

The survivor of husband and wife† ought to retain

* See present Volume of the Journal, p. 578.

† By the law of France the wife of an author, in the event of her surviving her husband, is entitled to the Copyright in his works during her life.—ED. *J. S. A.*

the same rights equally for life, and the personal representatives of, or other the persons entitled through the author, ought to enjoy them for fifty years, commencing either from the death of the author, or from the cessation of the widow's rights as the case may be.

2. In the applicability of these rights, there is no ground for drawing any distinction between different categories of works of literature and art, literary or musical compositions, or productions of arts of design.

There is no distinction to make between works appearing under a false name, and works published under the true name of the author.

Neither should the duration of rights be made to depend upon the condition of the persons entitled, whether children, personal representatives, or assignees.

3. The right of the first editor over an anonymous work ought to endure for 30 years, commencing from publication.

If the author makes himself known before the expiration of the term fixed by law, he ought to have the same rights which would have belonged to him if the work had originally appeared under his name.

4. With reference to posthumous works, if the rights of the author's widow, and of his personal representatives, or the persons entitled are not extinguished, the posthumous work ought to belong to them during a period equal to that which is allowed them by law.

If these rights are extinguished, the owner of a posthumous work ought to have an exclusive right to endure for 30 years, commencing from publication.

5. The exclusive right of the author should be guaranteed for publishing public lectures, sermons, and other discourses delivered in public, which cannot be published separately nor in the body of a work without the consent of the authors or of their representatives. With regard to addresses by advocates in Courts of Law, and speeches made in political assemblies, this consent ought only to be necessary for their publication in a collection of the speaker's works.

6. The right of the author over the reproduction of his original work, ought to carry with it the right of translation, subject to the following restriction:—The author should have for ten years, commencing from publication of the translation, the exclusive right of translating, or causing to be translated, his work into all languages, on condition of exercising this right before the expiration of the third year from the publication of the original work. If, at the expiration of the third year, the author has not availed himself of this right, everybody should have the power of exercising it concurrently, except in the country where the work originally appeared. After the expiration of the 10 years, although the author may have availed himself of his right, everybody should have the power of translating the original work, and of selling it in all countries except in that where it orginally appeared.

7. There is no reason for subjecting authors of works of literature or of art to certain formalities according to their right. If some particular formalities may be of use, whether as a measure of administration and of regularity, or whether as a means of establishing and proving the right of property; if it is expedient to ensure the observance of these formalities by any sort of sanction, their non-observance cannot and ought not to involve a forfeiture of the right. It is important to render these formalities as simple as possible. *Registration*, and the depositing of one or more copies of the work in the hands of a public functionary appointed for that purpose, seem to be the most advantageous method.

III. *Questions relating to the Representation and Execution of Dramatic and Musical Works.*

1. The right of *representation* of dramatic or musical works ought to be independent of the exclusive right of reproduction.

2. There is no reason for drawing any distinction between the two rights with regard to the duration of their enjoyment.

3. The right of property in musical compositions ought to be a barrier to the execution in public of every part of the musical work, without the consent of the composer, whatever the importance of the work may be, and whatever the mode of execution. But, where no pecuniary advantage is joined with interest in Art, the composer's right ought not to be asserted for the purpose of throwing impediments in the way of concerts, whether private or public.

4. The right of property in musical compositions ought to include the right of composing arrangements founded upon the subjects (*motifs*) of the original work.

IV. *Questions relating to Works of Design.*

1. The author of a drawing, a picture, a work of sculpture, or architecture, or of any other artistic work, ought to have the right of reproducing it, or of authorising its reproduction, by a similar or distinct method in art, and upon either an analogous or a different scale.

2. The unauthorised reproducer ought to be liable to the penalties of piracy when there is usurpation of name, without prejudice to the penalties incurred by a forger, if the piracy amounts to an *imitation* of signature.

3. The right of property in original designs ought also to embrace the applications which may be made of those designs for industrial purposes.

4. Particular formalities ought not to be required for Works of Art any more than for literary productions, as an absolute condition for acquiring and preserving property in them. Nevertheless, as in one case so in the other, some formalities may be desirable, as a measure of regularity, and for facilitating the proper exercise of the right. The works might be *registered*, and the certificate of registration, which would be delivered to the artist, would permit him to prove the authenticity of the work, whether it be in his own possession or in that of his grantees, and, if it should so happen, the authenticity of copies also.

V. *Questions upon the Economy of the Subject.*

The Congress desires:—

1. The abolition of duties on books and Works of Art, or, at least, the reduction of those duties to the most moderate rate, and their simplification so far as the tariff establishes different duties by category for literary productions.

2. The power of re-entry free of duty for works sent abroad on commission and not sold.

3. The diminution of the postal taxes to the utmost possible extent on all the routes, and the increase of facilities for the despatch and circulation of printed works, of engravings, and other articles capable of being despatched by post.

4. The assimilation of proofs with corrections to the final impressions, in the countries where the regulations establish a difference.

5. The suppression of all the formalities which shackle the book-trade."

These resolutions, emanating as they do from the distinguished body of men of all nations who passed them, form a new era in the history of legislation affecting property in original works of literature and of art. However any one acquainted with the subject may differ from the Congress upon some of the minor points included in the resolutions, it is surely impossible for any one to differ from those involving the great point of international protection for copyright works.

Authors of literary and artistic productions are deeply indebted to the Congress for their important labours, and authors will best repay that debt by exerting themselves to the utmost to promote and carry out the chief reforms suggested by the Congress.

BRITISH ASSOCIATION, LEEDS, 1858.

ON THE MEASUREMENT OF WATER BY WEIR BOARDS.

The following report, by JAMES THOMSON, A.M., C.E., Professor of Civil Engineering, Queen's College, Belfast, on the progress of experiments on this subject, was read before the Mechanical Section:—

The experiments proposed to be comprehended in the investigations to which the present interim report of progress relates, have for their object to determine the suitablenes of triangular (or V-shaped) notches in vertical plates for the gauging of running water, instead of the rectangular notches in ordinary use. The ordinary rectangular notches, accurately experimented on as they have been, at great cost and with high scientific skill in various countries, with the view of determining the necessary formulas and coefficients for their application in practice, are, for many purposes, suitable and convenient. They are, however, but ill adapted for the measurement of very variable quantities of water, such as commonly occur to the engineer to be gauged in rivers and streams. If the rectangular notch is to be made wide enough to allow the water to pass in flood times, it must be so wide that for long periods, in moderately dry weather, the water flows so shallow over its crest, that its indications cannot be relied on. To remove in some degree this objection, gauges for rivers or streams are sometimes formed, in the best engineering practice, with a small rectangular notch cut down below the general level of the crest of a large rectangular notch. If, now, instead of one depression being made, for dry weather use, in a crest wide enough for use in floods, we conceive of a large number of depressions, extending so as to give to the crest the appearance of a set of steps or stairs, and if we conceive the number of such steps to become infinitely great, we are led at once to the conception of the triangular instead of the rectangular notch. The principle of the triangular notch being thus arrived at, it becomes evident that there is no necessity for having one side of the notch vertical, and the other slanting; but that, as may, in many cases, prove more convenient, both sides may be made slanting, and their slopes may be alike. It is then to be observed that, by the use of the triangular notch, with proper formulas and coefficients, derivable by due union of theory and experiments, quantities of running water from the smallest to the greatest, may be accurately gauged by their flow through the same notch. The reason of this is obvious from considering that, in the triangular notch, when the quantity flowing is very small, the flow is confined to a small space admitting of accurate measurement; and that the space for the flow of the water increases as the quantity to be measured increases, but still continues such as to admit of accurate measurement.

Farther, the ordinary rectangular notch, when applied for the gauging of rivers, is subject to a serious objection from the difficulty or impossibility of properly taking into account the influence of the bottom of the river on the flow of the water to the notch. If it were practicable to dam up the river so deep that the water would flow through the notch as if coming from a reservoir of still water, the difficulty would not arise. This, however, can seldom be done in practice; and, although the bottom of the river may be so far below the crest as to produce but little effect on the flow of the water when the quantity flowing is small, yet when the quantity becomes great, the "velocity of approach" comes to have a very material influence on the flow of the water, but an influence which it is usually difficult, if not impracticable, to ascertain with satisfactory accuracy. In the notches now proposed, of triangular form, the influence of the bottom may be rendered definite, and such as to affect alike (or, at least, by some law that may be readily determined by experiment) the flow of the water when very small, or when very great, in the same notch. The method by which I propose that this may be effected, consists in carrying out a floor, starting exactly from the vertex of the notch, and extending both upstream and laterally, so as to form a bottom to the channel of approach, which will both be smooth and will serve as the lower bounding surface of a passage of approach, unchanging in form, while increasing in magnitude at the places, at least, which are adjacent to the vertex of the notch. The floor may either be perfectly level, or may consist of two planes, whose intersection would start from the vertex of the notch, and, as seen in plan, would pass up stream perpendicularly to the direction of the weir board; the two planes slanting upwards from their intersection more gently than the sides of the notch. The level floor, although theoretically not quite so perfect as the floor of two planes, would probably, for most practical purposes, prove the more convenient arrangement.

With reference to the use of the floor, it may be said, in short, that by a due arrangement of the notch and the floor, a discharge orifice and channel of approach may be produced, of which (the upper surface of the water being considered as the top of the channel and orifice,) the form will be unchanged, or but little changed with variations of the quantity flowing; very much less, certainly, than is the case with rectangular notches. The laws regulating the quantities of water flowing in such orifices as have now been described, come naturally next to be considered. Without, however, in the present interim report, attempting to enter on a detailed discussion of theoretical considerations on this subject, I shall here merely advert briefly to the principal results and methods of reasoning.

By theory I have been led to anticipate that the quantity flowing in a given notch should be proportional, or very nearly so, to the $\frac{5}{2}$ power of the lineal dimensions of the cross section of the issuing jet, or to the $\frac{5}{2}$ power of the head of water over the vertex of the notch. This head is to be understood, in the case of water flowing from a still reservoir, as being measured vertically from the level water surface in the reservoir, down to the vertex of the notch; or in the case of water flowing to the notch with a considerable velocity of approach over a floor arranged as above described, the head is to be considered as measured vertically from the water surface, where the motion is nearly stopped by the weir board at a place near the board, but as far as may be found practicable, from the centre of the notch. The law here enunciated, to the effect that the quantity flowing should be proportional to the $\frac{5}{2}$ power of the head, I consider should hold good rigidly in reference to water flowing by a triangular notch in a thin vertical plate, from a large and deep reservoir of still water, if the water were a perfect fluid, free from viscidity and friction, and from capillary attraction at its surface, and from any other slight disturbing causes that may have minute influences on the flow, the flow being supposed to be that due simply to gravitation resisted by the inertia of the fluid. The like may be said of water flowing from triangular notches with shallow channels of approach, having floors as described above, when due attention is given to make the passages of approach so as really to remain unchanged in form for a sufficient distance from the notch, while increasing in magnitude as the flow increases (such being supposed according to my theory to be possible), and if due attention be paid to the measuring the heads in all cases in positions similarly situated with reference to the varying dimensions of the issuing streams.

In illustration of these statements, or suppositions, I would merely say, that, if two triangular notches, similar in form, have water flowing in them at different depths, but with similar passages of approach, the cross section of the two jets at the notches may be similarly divided into the same number of elements of area; and that the areas of the corresponding elements will be proportional to the squares of the lineal dimensions of the

cross sections; or, as from various considerations, may readily be assumed, proportional to the squares of the heads; also the velocities of the water in the corresponding elements may be taken as proportional to the square roots of the lineal dimensions, or to the square roots of the heads. From these considerations, supported by numerous others, it appears that the quantities flowing should be proportional to the products of the squares of the heads into their square roots, or to the $\frac{5}{2}$ powers as already stated.

The friction of the fluid on the solid bounding surfaces of the passages of approach, where the water moves rapidly adjacent to the notch, may readily be assumed from all previous experience in similar subjects, not to have a very important influence even on the absolute amount of the flow of the water; and if we assume (as is known to be nearly the case for high velocities, such as occur in notches used for practical purposes, unless unusually small) that the tangential force of friction of the fluid per unit of area of surface flowed along, is proportional to the square of the velocity of flow, it follows by theory that the friction, though slightly influencing the absolute amount of the flow, will not, according to that assumption, at all interfere with its proportionality to the $\frac{5}{2}$ power of the head. And this condition will very nearly hold good if the assumption is very nearly correct.

How closely the theory thus briefly sketched may be found to agree with the actual flow of water, will be a subject for experimental investigation; and whatever may be the result in this respect, the main object must be to obtain for a moderate number of triangular notches of different forms, and both with and without floors at the passage of approach, the necessary co-efficients for the various forms of notches and approaches selected, and for various depths in any one of them, so as to allow of water being gauged for practical purposes when in future convenient, by means of similarly formed notches and approaches. The utility of the proposed system of gauging, it is to be particularly observed, will not depend on a perfectly close agreement of the theory described with the experiments; because a table of experimental co-efficients for various depths, or an empirical formula slightly modified from the theoretical one, will serve all purposes.

To one evident simplification in the proposed system of gauging, as compared with that by rectangular notches, I would here advert, namely, that in the proposed system the quantity flowing comes to be a function of only one variable, namely, the measured head of water, while in the rectangular notches it is a function of at least two variables, namely, the head of water and the horizontal width of the notch, and is commonly, also, a function of a third variable very difficult to be taken into account, namely, the depth from the crest of the notch down to the bottom of the channel of approach; which depth must vary in its influence with all the varying ratios between it and the other two quantities of which the flow is a function.

The proposed system of gauging also gives facilities for taking another element into account, which often arises in practice, namely, the influence of back water on the flow of the water in the gauge, when, as frequently occurs in rivers, it is found impracticable to dam the river up sufficiently to give it a clear overfall free from the back or tail water For any given ratio of the height of the tail water above the vertex of the notch, I would anticipate that the quantities flowing would still be, approximately at least, proportional to the $\frac{5}{2}$ power of the head as before, and a set of co-efficients would have to be determined experimentally for different ratios of the height of the head water to the height of the tail water above the vertex of the notch.

With the aid of the grant placed at my disposal by the Association at last year's meeting, for the purpose of these researches, I have got an experimental apparatus constructed and fitted up at a place a few miles distant from Belfast, in Carr's Glen, on the grounds of Mr. Neeson, who has kindly afforded me all the necessary facilities regarding the water supply and the site for the experiments, and I have got some preliminary experiments made on a right-angled notch in a vertical plane surface, the sides of the notch making angles of 45° with the horizon, and the flow being from a deep and wide pool of quiet water, and the water thus approaching the notch uninfluenced by any floor or bottom. The principal set of experiments as yet made were on quantities of water varying from about two to ten cubic feet per minute, and the depths or heads of the water varied from two to four inches in the right-angled notch.

From these experiments I derive the formula $Q=0{\cdot}317\ H^{\frac{5}{2}}$, where Q is the quantity of water in cubic feet per minute, and H the head as measured vertically in inches from the still water level of the pool down to the vertex of the notch. This formula is submitted at present temporarily, as being accurate enough for use for ordinary practical purposes, for the measurement of water by notches similar to the one experimented on, and for quantities of water limited to nearly the same range as those in the experiments; but as being, of course, subject to amendment by more perfect experiments extending through a wider range of quantities of water.

Out of the grant of £10 from the Association for these experiments, the amount for which I have hitherto had to apply to the treasurer as having been expended in them is £8 0s. 4d., which leaves a balance remaining of £1 19s. 8d.

It will be readily observed that the experimental investigations indicated in the foregoing report as desirable, are such as would require for their completion and extension to large flows of water a great expenditure both of time and money, like as has already been the case with researches on the flow of water in rectangular notches. All that I can myself, for the present, propose to attempt is to open up the subject with experiments on moderately small flows of water; and with this view I would be glad to be aided by a further grant from the Association in continuing experiments of the kinds already undertaken.

NOTES FROM THE GOLD COAST.

By M. C. Cooke.

It would be a task scarce worthy the pains, to string together the following notes and memoranda, culled from a private correspondence, did they relate to almost any other part of the world than Western Africa. But so little reliable information comes from that quarter as to make the gossip of a letter-writer interesting to the majority of readers. Under this impression, whether true or false, I have culled the following remarks from a series of letters received during the last few years from a correspondent at Cape Coast, in the hope that they might prove of interest to your readers.

"The West African mails leaving on the 24th of each month, call on the 31st at Madeira, on the 2nd at Teneriffe, on the 6th at Goree, on the 7th at Bathurst (on the Gambia), on the 10th at Sierra Leone, on the 13th at Mowrovia, arriving on the 17th at Cape Coast Castle."

The party of eleven, of which my correspondent was one, having arrived at their destination, he confirms the following account of the general characteristics of the coast:—

"The more western portion of the Gold Coast has an undulating surface, with a bold and rocky front to seaward. But the greater part of the territory consists of level, fertile, and open plains, covered in some places with tall grass, and in others with lofty forest trees. The shores are here flat and sandy, and the whole range of coast is entirely destitute of harbours."—Hughes.

This sketch is tolerably correct. There are plenty of moderate-sized hills to the rear of us, and they are all

covered with "bush" or low trees quite down to the town. The country is mountainous far to the eastward of us, and there are no bays of any magnitude on this part of the coast."

Adverting to the climate of this locality, so fearfully fatal to Europeans within twelve months after his arrival, the following information confirms its right to the title of the "white man's grave."

"But as to temperature, your dog-days would in comparison be quite cool and refreshing. There is not one European now resident in the town. The last, a young Scotch trader, died a day or two ago. Of the eleven who formed our party to the coast last year, seven have died, three have gone back very ill, and *one* remains."

"Our winter season commences in May, when the temperature falls to about 80° or 82°, with 'muggy,' rainy weather. It is the most unhealthy period, and is disliked by the natives, who are sensible of even *one* degree below the average warmth. Yet it is more congenial to European feelings, and as such one is pleased to exchange for it this present state of continual perspiration."

At length the rainy season arrives, and as it passes comes the consolation "we have passed through the worst part of the rainy season, and now experience alternations of fine weather and drizzling showers, and mists. I often think of the golden harvests now waving over the fair fields of England, and the interest of gathering in the successive crops of autumn, while here it is wearisome; there is nothing to mark the course of seasons except rain and dry; 'tis the same all the year round. This is a terrible place for destroying all polished metals. Razors, &c., require constant care. Put anything away for a day or two, whether of this kind or of clothing, and it may be irrecoverably injured by damp. I have just written this letter with a bad iron pen, and as to quills, you can't keep a penknife in order to mend them, owing to the damp, which, together with ants, moths, and cockroaches, makes one cry out 'persecution' many a time and oft."

Another communication, despatched in November, describes another change; it is now the "dry season," and "while, at this moment," it states "you are enveloped in a raw, cold, foggy atmosphere, scarce seeing the sun for days together, or shivering amid frost and snow, here we are under a cloudless sky, of intense blue and a burning radiance. What would we give to exchange an African sunbeam for a snowball, or a few fresh-gathered icicles, luxuries for which you might have whole cargoes of the finest tropical fruits, and our barterer would esteem himself the winner of a prize. However, as it is, we must be content with such things as we have. Our pines at three half-pence; cocoa nuts, full of milk, clear as crystal (and the pulp a beautiful jelly, taken out with a spoon), at one penny each. Green oranges tolerably cheap. I have just seen a bunch of oranges, about twenty in number, as closely set as a bunch of grapes. It is even here considered a wonderful production. On the whole, however, things are dearer here than in England, and heavy freights render importations very expensive. The other day I gave sixpence for a few common lucifers, which, at home, you would get for a farthing.

"With this month (November) began our summer, and its height will be in December, so that during the day it is imprudent to go out at all if it can be avoided, *i.e.*, between 6.30 a.m. and 6 p.m., and then you have barely an hour before it is quite dark, moonlight of course excepted."

Another letter in that and also in the succeeding year, informs me that there had been no Harmattan, and that as the dry season drew towards its close, the natives were complaining that the "time was out of joint;" but that "tornados were daily hoped for in order to bring rain, which was much needed." Having, however, quoted enough having reference to the climate, let us turn to the people, resident and native.

"The native girls wear a 'kankey,' or artificial hump, on their backs (and nothing else) as soon as they can walk, in order to learn betimes to carry their juniors, who ride astride on the said projections. The actual usefulness of them consist in enabling the mothers to work with their infants in this way on their backs, while in England they excuse themselves from work on the plea of an infant in arms."

A circumstance is afterwards narrated in which the native population appear in less flattering colours. It occurred at a short distance from the narrator, and came somewhat officially under his notice. "A man died, and the natives inquired of the dead, 'Who killed him.' The body was carried round for the ordeal, and 'knocked' at a young man as it passed him. The savages immediately fell upon the accused with cutlasses, then left him awhile, burning and writhing in the sun, shortly to return and cut off his head."

Let us hope that such occurrences as these are few and far between, and seek relief in the doings at the garrison. "Christmas eve was most uproarious here, for exactly at twelve all the troops began firing their muskets as hard as they could through the loopholes all around the fort, making night hideous and sleep impossible. Next day they had a feast in the afternoon; moonlight soon followed, when the drums struck up for a regular dance; and where, think you, was all this capering of pas-seuls, waltzes, &c., but over the grave of poor L. E. L. and her husband—twelve flat red tiles marking the one, yellowish London bricks the other.

"But the banquet of the year for the troops is given on the Queen's birthday. A large tough piece of roast beef was the marvel of the last anniversary, with some waxy old potatoes and a dish of radishes—actually live, red radishes, and everybody was ready to jump up and knock every other body down in order to grasp and 'crunch' them. You may well congratulate yourselves on the nice things coming in with the season, while here they are all out of season all the year round—no rhubarb and sea-kale and grass; no gooseberries and currants; no new potatoes, peas, or beans; no strawberries and cherries; no apples and pears. No, nothing of the sort. But here they have fish-soup, made of dry unsalted fish, by way of a luxury; also snail-soup, with land-crabs in it. And beyond Ashantee the food consists of plantains and snails, 300 or 400 dried on a string for a dollar."

Being interested in natural history, I have at different times sent out queries relating to objects of interest believed to be known in that part of the coast. To these queries the replies have been such as are detailed below. There is no little difficulty in procuring information or specimens, as those replies will shew. And, however well-intentioned a person located on the coast may be to render service, there is evidently something even beyond that requisite, and intelligent explorers seldom venture into the interior.

"No one here takes any interest in natural history. A 'bumbafoo,' or huntsman, goes out with his gun, and brings home birds and beasts, but as to telling you anything of their character or habits, it is out of the question.

"If I attempt any inquiry, ten to one I get answers flatly contradicting each other; as yesterday, for instance, one gentleman of long experience affirming that there were no snipes on the coast, and another, of short experience, declaring he had shot them often in the neighbourhood.

"The fact is that it is as difficult to get suitable jars or bottles with corks for specimens as to get the specimens themselves, and, in some cases, more so. Suppose, for instance, I want to send such a thing as a land-crab. A jar wide enough for its reception at the mouth, is probably a vast deal too large and too heavy to be used for the purpose, and, next, how to find a cork tight enough. No shops here for such things, and probably the original

stoppers are so injured as to be useless; so that the exterior is to be as much prized on such occasions as the interior curiosities.

"I wish I could send you a large shark, which the natives are triumphantly hauling up the beach within a few yards of me. Lately I lost a very kind friend and a principal merchant at Cape Coast. A few weeks since he left the shore in a canoe to go on board the steamer anchored in the roadstead. It was upset on the surf, and, in a moment, himself and a native lady and a servant girl were devoured by these voracious monsters. They will actually jump up out of the water trying to catch men who may be suspended over a ship's side painting or cleaning the vessel.

"Savage hyænas (pattakoos they call them) prowl and growl on a low ledge of rocks between the castle wall and the ever-thundering surf every night, to see what they can find, and their horrible footprints are visible enough on the sand every morning. A few weeks ago one of these wild beasts carried off a little girl in a neighbouring town as she was incautiously venturing by herself across its path. They certainly make all kinds of strange noises, imitating many voices that are in the world, whether pigs, sheep, or fowls, in order to decoy them within their voracious clutches. We hear of some large ourang-outangs having been lately seen a short distance from the town, and people now go in that direction with a sharp look out, and never alone.

"A red flamingo was brought here from Ashantee some years ago, but I cannot find any person who has seen the bird as a native. At this moment I observe the flight of seven pelicans. The marabout stork is never heard of here. Senegal and the Gambia are its localities, and you may get the tail-feathers sometimes for a dollar, sometimes for ten or twelve, or not at any price. The merchant's general charge is 24s. per ounce. Wild ducks are sometimes visible in the air; Muscovy ducks waddling on the ground; common domestic ducks are now in the larder, but very lean indeed. There are plenty of wrangling, quarreling, spiteful, pugnacious, love-birds. Gulls seen occasionally. The secretary bird not known here. There are plenty of the crown bird or crowned crane on the Coast, but not on this part of it. Locusts, not the Egyptian, are sometimes here in clouds, eating up everything.

"You will be glad to hear that an important desideratum is about to be supplied, in a work by Mr. Louis Fraser, naturalist to the last Niger expedition, on the Birds of Western Africa, with coloured plates. It is advertised in a Sierra Leone paper.

"The ordeal bark is, I believe, from a tree in the interior, and is often administered as the test of guilt or innocence, but it is easily so prepared as to act either way, for or against the accused; retained if guilty, omitted if innocent. Various seeds and small cowries are cut into uniform shapes, to be worn like beads.

"The fruit called here a plum,* in shape and colour resembles a damson, but the pulp is more like tasteless pith than anything else. I have also heard of a peach here,† but it is nothing like our own, being merely a thin skin over a large stone."

From this locality I have received specimens of *Essowwee* (or teeth cleaner), a bunch of fibre of a coarse description, used there for that purpose and chew-sticks, which have a like application; a rough fibre, called *Essou*, obtained from a creeping plant, and used for personal washing instead of sponge; *Broodewah* or the fibre of the plantain, used for the same purpose; Pine apple fibre, used by the natives for making their fishing nets; plait for hats, made from the date palm; Cola nuts (fruit of *Sterculia acuminata*), ground nuts (*Arachis hypogea*), these are taken from the shell, parched, and eaten; Tiger nuts (the small tubers of *Cyperus esculentus*), "these are chewed, not swallowed. When pounded with water, about a cupful of nuts to a cup and a-half of water, strained, simmered, and cooled down, the result is a nice sweet kind of solid creamy substance;" *Lobutze* or physic nut, a species of Jatropha; Canna seed or Indian shot, and other seeds; palm nut kernels, gum copal, cotton, together with landcrabs, scorpions, birds, insects, &c., of no general interest. Without doubt there are many products of the Coast which would be commercially valuable, but no energy or skill on the part of the natives to make the most of their natural advantages. My correspondent writes,—

"There is plenty of field here for trade; the riches of nature are in abundance, without art to get them. Palm oil, gold-dust, ivory, pepper, &c., but the climate is *per contra*.

"The principal export trade here is gold dust; they send about 20,000 ounces annually to England, and formerly much more. The palm oil trade is more to leeward, and ivory to the west or windward.

"The export of dust last year was £32,303 to England, £200 to America, and £600 to other places. About 140 to 150 tons of ivory are annually sent from the coast. About £40,000 in value of palm oil to England, £20,000 to America, and £20,000 to other places. A small portion of palm oil is shipped from Cape Coast, but by much the greater is sent from the most easterly parts of the coast. These are several other exports from the gold coast, amounting in all to £140,000 or £150,000 annual value.

"Liberated Africans have a remarkably keen eye to the native dust. So much so that before long I think the traders of that class will drive the white men out of the field. At this place, a few years ago, there were forty European merchants, and now not *one*. There are only two or three white agents and clerks for African houses. The competition has been ruinous to the mercantile speculators.

Commerce and the condition of the place generally are, as they say, looking down. Not even a "bumbafoo" to be heard of, all owing to customs' dues burdening trade here, while our Dutch neighbours, close at hand, up and down, are quite free."

Trinity School-house, Lambeth.

* Malpighia saccharina.
† Sarcocephalus esculentus.

INTERNATIONAL DECIMAL ASSOCIATION.

At a meeting of the council of this association held on Thursday, the 28th October, the following report on the meeting of the National Association for the Promotion of Social Science, held in Liverpool, was presented by James Yates, Esq., vice-president, and adopted:—

"The late meeting at Liverpool was attended by the Earl of Shaftesbury and Mr. James Yates, two of the vice-presidents of the International Association; by Charles Paget, M.P., Edwin Chadwick, C.B., William Fairbairn, F.R.S., Dr. Farr and Dr. Hodgkin, members of the council; and Dr. Lee, T. T. Barnard, Esq., M.P., Professor Hennessy, Dr. Hine, Mr. Thomas Michell, H. G. Bohn, Esq., Mr., Fitch, Mr. Ashton Yates, Professor Traill of Edinburgh, and others. In consequence of the great number of memoirs presented to the fifth department, the general secretary, G. W. Hastings, Esq., proposed that those relating to decimal measures, weights, and coins, should be referred to a special section. This arrangement was attended with great advantages. The subject occupied the entire morning of Friday, October 15th, and one of the most spacious and commodious apartments in St. George's Hall was appropriated to the section. Lord Brougham, at whose suggestion the introduction of this topic had been resolved upon, kindly consented to take the chair, and the audience was numerous and attentive. At the commencement of the business Mr. James Yates produced letters from Viscount Ebrington, M.P., J. B. Smith, Esq., M.P., Professor L.

Levi, the Dean of Hereford, Mr. H. N. Sealy, formerly of Liverpool, M. Michel Chevalier, of Paris, M. Nordling, of Paris, M. Lamansky, secretary to the Geographical and Statistical Society of St. Petersburg, the Rev. Eugene Popov, Chaplain to the Russian embassy, M. Delavaleye, of Brussels, and other gentlemen, apologising for their absence, and expressing great interest in the plan of the International Association. Seven memoirs were read, as follows:

"Wm. Brown, Esq., M.P. for South Lancashire, showed the great trouble, inconvenience, and loss of time produced by the established system of money, observing that, if a decimal coinage were substituted for it, compound arithmetic would be superseded, and all calculations of accounts exceedingly simplified.

"Mr. Samuel Brown, Vice-President of the Institute of Actuaries, gave an account of the origin, plans, and objects of the International Association, a task for which he was singularly qualified, from having been one of its original founders, and uniformly a member of its council.

"The Rev. Alfred Barrett, M.A., North Cheam, Surrey, explained the advantages of the metrical system of measures, weights, and coins, in reference to education, and stated, as the result of his own observation, that the adoption of this system in the British islands would be a saving of time in the instruction of boys, amounting certainly to more than a year, perhaps almost two years.

"Mr. James Yates enumerated the points which seem to require attention, in order to arrive at a good system of decimal coinage, viz., the alloy, the seignorage, the remedy, the standard of value, the unit, the denominations, the number of decimal places, the highest and lowest coins, the relation to weights, the international principle, and Mr. Sealy's proposal of an international bank. He stated various facts in regard to each of these topics, and illustrated their application in trying the merits of different schemes.

"Mr. Tefft, Art Commissioner from Rhode Island, United States, having noticed the obstacles to commerce, and the perplexities to travellers, produced by a variety of monetary systems, proposed that a gold coin, equal to the new five-franc piece now current in France, should be the unit, and showed how, by slight modifications, the coinages of France and England and the United States, might meet upon this basis. He recommended that the coinage should be in strict unison with the weights and measures of the metrical system, and that the copper coins should be identical in weight and value with those of France.

"The Rev. C. H. Bromby, Principal of Cheltenham College, recommended the franc and centime system of coinage, with a gold coin of 100 francs in value, and entered into calculations to show the advantages of the system.

"Mr. Theodore Rathbone contended that a decimal system of measures, weights, and moneys might easily be adopted if a familiar quantity were taken as a standard, such as the pound weight, the yard, and the penny, and if these were adjusted to similar quantities in other countries.

"The reading of these papers, with the discussions upon them, occupied more than five hours. The international principle was opposed as chimerical and impracticable by Mr. W. Brown, Lieut.-General Sir Charles Pasley, and Mr. R. R. Moore. It was ably and strenuously defended by Mr. Theodore Rathbone and by Professor Hennessy.

"Remarks were made on the great value of the preliminary report presented by the Decimal Coinage Commission, of which Lord Monteagle is chairman, and especially on the importance of the information obtained from France, Belgium, Switzerland, the kingdom of Sardinia, and other foreign countries.

"Mr. Tite, M.P. for Bath, stated, as the result of his experience in various works which he had executed on the Continent, that the practical advantages of the metrical system are great almost beyond conception.

"Mr. M'Cann, M.P. for Drogheda, announced his intention of bringing in a bill in the next session of parliament for the abolition of dry measure.

"Mr. Philip Rathbone, local secretary, stated that he was in the habit of changing English accounts into the monetary scale of nations using the decimal system, and that this process, by enabling him to use logarithms, not only effected a saving of three-fourths of the time in computation, but afforded the best security against error.

"Notwithstanding the opposition of sentiment between the advocates of the pound and mil scheme and those who recommended an international system comprising measures, weights, and coins, there was only one feeling of admiration and gratitude towards the officers of the Association for Promoting Social Science, which had so liberally afforded the opportunity for discussion."

ROCK SALT IN PRUSSIA.

A correspondent of the *Daily News*, dating from Stettin, states that a discovery of the utmost importance for the trade of Prussia and the countries on the Baltic generally, has lately been made at a place called Strassfurt, near that city, consisting of an inexhaustible bed of pure rock salt. It is now some months since vague and uncertain reports of the discovery were circulated there, but they were at first discredited, on the ground that the geological features of Pomerania, being of alluvial and diluvial formation, were not of a nature to cover a large deposit of salt, although it was known that there are, in many parts of the province, saline springs which are used by the government for the artificial manufacture of salt.

The fact of the discovery is, however, now stated to be well authenticated. A small cargo has been sent this summer to Scotland, to be used in salting herrings, and the quality is said to be even superior to the Liverpool rock salt. As these salt beds are of very considerable extent, and from their proximity to the sea, the produce can be raised and shipped at a very low figure, the discovery is likely to bring about an important revolution in the salt trade, which, in Prussia, is a government monopoly; indeed, the Minister for Commerce has, in consequence of the discovery, ordered the saline works at Colberg and Cösen to be discontinued, it being found impossible to compete profitably, by any artificial means, with this prolific natural store. Government has fixed the price for the present at six silbergroschen per centner (equal to about 11s. sterling per ton), delivered free on board at Strassfurt, which is about the shipping price at Liverpool. It is, however, thought probable that a great reduction will take place, as the actual cost of production only amounts to one-fourth of the above figure.

The writer adds:—"Under these circumstances the large importations of salt annually received from England will, of course, altogether cease, and the Strassfurt rock salt will be able, from the extreme cheapness of its production, to compete successfully with Liverpool for supplying Russia and the other Baltic States with this necessary article, thus creating a new and lucrative branch of commerce for the merchants of Prussia. An unlimited supply of cheap salt will also have a corresponding favourable effect on the development and increase of many chemical articles manufactured in Prussia, in which salt is the principal ingredient. The falling-off in our imports of salt, soda, &c., will, however, be more than compensated by the increase of exports in this town which cannot fail to take place, and thus tend to restore the just equilibrium between our imports and exports, the former having, for several years past, considerably predominated—so much so, that a large part of the vessels bringing goods to Stettin are unable to find

return freights, and are therefore compelled to sail in ballast, which tends to materially raise the inward freights on cargoes bound for this port."

Home Correspondence.

SHIPPING REGISTRATION, TONNAGE, AND ENGINE-POWER.

SIR,—The *Journal of the Society of Arts* having been liberally thrown open to public discussion on the deficiencies and absurdities of our present system of Shipping Registration and Tonnage and Engine-power admeasurement and record, as exemplified by the papers, "Steamship Capability," "Tonnage Registration," and "Mercantile Steam Transport Economy," published in the *Society of Arts Journal* for the 18th May, 1855, 18th January, 1856, 15th and 22nd August, 1856, and 28th August, 1857, I now request the favour of your giving insertion to the inclosed excerpts from City articles of the *Times* for the 25th and 30th Oct., as a practical confirmation of the anomalies to which I have endeavoured to direct public attention by the papers above referred to.

I am, &c.,
CHARLES ATHERTON.

Woolwich Dockyard, 27th Oct., 1858.

[EXTRACTS REFERRED TO.]

The following is the explanation furnished regarding the discrepancies between the alleged and actual tonnage and horse-power of the vessels named in the prospectus of the new Atlantic Steam Company from Galway. The registered capacity is rarely heeded, and it is now a general custom for each shipbroker to suit more or less his own fancy as to the limits within which he will confine his descriptions. An immediate and authoritative reform should be brought about:—

"8, Philpot-lane, London, Oct. 23.

"SIR,—Pressure of business has hitherto prevented us from noticing an extract from the *Liverpool Courier* of the 9th inst., and recently commented on by you, which seems to have been widely circulated in this city with an object which is very apparent. As the advertising of the steam-ships of the Atlantic Royal Mail Steam Navigation Company rests with us, as the brokers to the company, we beg to state in explanation, that in advertising the burden tonnage of the ships and effective power of their engines, we merely followed the custom generally prevailing among brokers, and the only omission we can admit is that of the words 'burden' and 'effective,' which henceforth you will see in our advertisements in the columns of your paper. We enclose advertisement slips cut out of your paper of this date and those of your contemporaries, from which you will see the custom above alluded to is general, and we may add, that in more than one of our ships we have considerably understated both burden and effective power.

"Every one acquainted with shipping is aware that the Customs' admeasurement tonnage and the Admiralty horse-power are merely nominal, and not at all indicative of the actual burden of ship or horse-power of engines.

"For the information of the curious, we refer them to the last Merchant Shipping Act, wherein they will find the key to the relative proportion between register and burden tonnage, and from which they will see our advertisements are not overstated.

"We are, Sir, your obedient servants,
"BAKE, ADAMS, AND Co."

The following relates to the controversy which has arisen out of the recent advertisements of the Galway Atlantic Steam Company, as to the practice of the shiprokers of London and Liverpool in describing the tonbage and power of vessels. It is evident that much laxity has prevailed, and that the time has arrived to put a stop to it. There could be no objection to brokers giving their own estimates, providing the official figures are also stated:—

"London, Oct. 28.

"SIR,—Will you allow me to point out two or three things in reference to the controversy respecting the advertisements of the Galway line of steamers? Considering the locality whence the attack made on the new company was commenced it is not very difficult to understand the motive. For years past I have advocated schemes of which the Galway undertaking forms a part, and to the complete realization of which I believe that it will ultimately lead; I therefore naturally entertain a just indignation when I see that which I consider contrary to truth and fair-play put in requisition to injure the Galway line in public estimation. This, I am persuaded, you will never for a moment countenance, and I address to you these few lines, either for publication or not as you may think proper. You inserted a letter signed 'Veritas' in your City Article of to-day, the writer of which says:—

"'I enclose you the advertisement of every Transatlantic steam line advertised in the Liverpool newspapers, and the Galway line is the only one stating an imaginary tonnage.'

"Now I do not know what the Liverpool papers advertise, but I beg to refer you to *The Times* of this date for the advertisements of Liverpool steamships, There you will find at the bottom of column IV., page 1, of the supplement, the *Great Britain* (of a Liverpool line, and belonging to Messrs. Gibbs and Co.) advertised as 3,500 tons register. I turned to the *Steam Shipping Register* this afternoon, and found her there registered as 1,811 tons. The *Eagle*, which appears directly after, is advertised as 2,500 tons, and I find in Lloyds' book that she is registered 1,020 tons.

"Again, turn to the White Star line and Black Ball lines. I find certain vessels belonging to these advertised as of 5,000 tons burden. It is true that the registered tonnage of these lines is given, which is by no means generally the case. But their advertisers, in estimating their burden in proportion to their registered tonnage, have, I think, somewhat exceeded Messrs. Bake, Adams, and Co.'s calculation. All that Messrs. Bake, Adams, and Co. can be accused of is, that they have left out their register column and given the burden of their vessels alone. That this is by no means a singular proceeding is sufficiently proved by *The Times*' advertising columns of to-day. "I am, &c.,
"SCRUTATOR."

Proceedings of Institutions.

WARMINSTER ATHENÆUM.—The opening of the new buildings recently erected by the members of the Warminster Athenæum, was inaugurated on Thursday, the 28th ult. A public meeting was held in the lecture-room, at which the Marquis of Bath presided, supported by the Right Hon. Sidney Herbert, M.P., Lord H. Thynne, the Hon. and Rev. S. Best, Mr. E. Baines, of Leeds, president of the Yorkshire Union of Mechanics' Institutes, the Rev. A. Fane, vicar of Warminster, and a large number of the gentry and clergy of the town and neighbourhood. The Marquis of BATH opened the proceedings in a brief speech, in which he pointed out the advantages which the town of Warminster would receive from the establishment of the institution.—Mr. WARREN, the secretary, then, at the request of the chairman, read a statement of the financial position of the Institution, after which the Right Hon. S. HERBERT, M.P., rose to move the first resolution. He began by contrasting the mode in which such Institutions as this were established in France,

where the support and patronage of the Government were considered essential to success, with the more independent system adopted in England. With reference to the advantages of such Institutions, he confessed he was at a loss what to say, for during the last six weeks we had had this subject put before us in every possible light, and argued in every possible manner by the most illustrious and able men which the country had produced in the present day. He thought, however, that the discussions which had lately taken place, had enabled us to get at a far more correct view of what the intentions and objects of these Institutions really were, and what they were likely to accomplish, than we possessed before. He recollected at one time, that the opinion very much taken up was, that these Institutions, by offering to all the means of studying abstruse science, would have the advantage of creating, at any rate of increasing, the number of eminent men in literature and science—that they would, in point of fact, be the nurseries of men like Hugh Miller, Stephenson, or Dr. Livingstone—men who struggled through every disadvantage in their determination to encounter and conquer learning. For his part, he did not believe that Institutions of this kind had any such effect, and he did not think it right that they should have any such effect. Men ought to meet here for purposes of intellectual recreation, and not necessarily for laborious study. Stephenson, Hugh Miller, and such men did not want opportunities given to them, they made them. They were not the creatures but the authors of opportunity. The fact was that when people made rules for others, they took a very high standard. They were very virtuous when making regulations to affect the conduct of other people, and many of these societies had begun by purging their libraries of books of amusement. He was not against offering abstruse books to those whose tastes would lead them to study science, but let them not let their library be restricted to such books. Really good novels were, in his opinion, a great school of human nature, and such works were not out of place in the library of a literary institution. Then, again, the reading of newspapers in these Institutions was equally justifiable. They were, in fact, contemporary history, besides giving us most admirable discussions upon all the questions of the day. It was true that at present newspaper writers were anonymous, and his belief was that, for the mission of public instruction, that was a great disadvantage, as it put on a par, in point of weight and authority, the most scrupulous and the most unscrupulous writer—the most exact and the most inexact. He had stated his views on this point, because it was to the press that we must look for the formation of the great mass of public opinion on political and social questions, and it was of importance to watch with the greatest care any defects capable of remedy which diminished the good influence the press exercised. The diffusion of information had contributed to the present comparative absence of party spirit in the country. The mass of the people were now as intelligent as those they returned to represent them, and the result was that, judging for themselves, they found some good on one side, some on another, and they would not yield themselves blindly to the lead of any one man or party in the State. The proposed extension of the suffrage would, if carried, produce an enormous extension of that jury which was to decide in a calm reasoning manner on the great questions of the day. Learning, then, must no longer be a monopoly of those who had leisure and wealth to obtain it, but it must go further, and for such a purpose institutions such as this were invaluable. In conclusion, he trusted that they would agree with him in accepting with warmth and cordiality the resolution which he had then the honour to read to them, "That the Warminster Athenæum, being an institution calculated to advance the moral, social, and intellectual progress of the town and neighbourhood, the cordial thanks of the public are due to its promoters."—The Hon. and Rev. S. BEST, in seconding the resolution, said he dissented from some of the opinions which Mr. Sidney Herbert had expressed. He took a somewhat sterner, and, perhaps, not so agreeable, a view of the duties of an Institution like this. He admitted the social advantages to be derived from reading good novels or newspapers, but other matters were to be attended to in training the mind in order to enable it to distinguish the force of truth. The great object of Institutions such as this was, in his opinion, to take the young when they left school, to educate them practically, and continue their education either by means of mutual instruction or by means of appointed masters. The resolution having been unanimously agreed to,—Mr. EDWARD BAINES proposed the next resolution—"That this Institution recommends itself to the support of the friends of education, as designed to promote the self-improvement of the young, and the general diffusion of knowledge apart from religious and political opinion." He agreed most cordially with what had been said by the right hon. gentleman in regard to the desirableness of not forbidding in these Institutions relaxation and intellectual amusement. Very many years ago he had dissented from the view taken of Mechanics' Institutes by their founders, Dr. Birkbeck and Lord Brougham, that they should be entirely devoted to scientific study, and he believed experience had since proved that he was right. At the same time he thought there was something higher to be gained from Mechanics' Institutions than mere intellectual amusement. He, therefore looked with much satisfaction upon the efforts which had been made in the town of Warminster to extend their institution and render it more useful.—The Rev. A. FANE seconded the resolution, which was unanimously agreed to. Several other addresses having been delivered, the proceedings terminated with a vote of thanks to the Chairman. After the meeting a dinner took place at the Town Hall, at which the Marquis of Bath presided, and the festivities were concluded by a *soirée* in the evening.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Geographical, at Burlington House, 8½. I. Mr. R. F. Thomson and Lord Schomberg H. Kerr, "Journey through the Mountainous Districts North of the Elbury, and Ascent of Demavend, in Persia. II. Mr. A. C. Gregory, "Journey from Moreton Bay to Adelaide in search of Leichhardt." III. Mr. F. Gregory, "Exploration of the Murchison, Lyons, and Gascoyne Rivers in Western Australia."

TUES. ......Syro-Egyptian, 7½. Mr. W. F. Ainsworth, "On Ancient and Modern Antioch."
Civil Engineers, 8. Mr. J. S. Valentine, M. Inst. C.E., "Description of the Lisbon and Santarem Railway."
Med. and Chirurg., 8½.
Zoological, 9.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Oct.* 29, 1858.]

Dated 22nd September, 1858.

2132. C. W. Harrison, Woolwich—Imp. in filters for purifying air and liquids.

Dated 11th October, 1858.

2260. R. Cowen, jun., Nottingham—Imp. in dressing lace or other fabrics made of silk, cotton, or other material, and in apparatus employed therein.

Dated 12th October, 1858.

2269. J. F. Swinburn, Birmingham—Imp. in fire-arms.
2271. T. C. Shaw, and F. H. Cooper, Hanley, Staffordshire—A new or improved construction and mode of working engines by the agency of air or gases in conjunction with electricity for obtaining or producing motive power.
2273. W. Smith, Edinburgh—Imp. in transferring drawings or delineations in lithographic and zincographic processes.
2275. J. A. Gasse, Paris—Imp. in railway breaks and in apparatus for working the same.

Dated 13th October, 1858.

2278. J. Parkins, 1, Hanway-street, Oxford-street—Imp. in securing envelopes, and in fastenings to be used therein.
2279. H. Parker, Sledmere Castle, Yorkshire—An improved apparatus for the cultivation of land, and other agricultural operations.

2280. R. Ridley, Low Wortley, Yorkshire—Imp. in safety cages for mine shafts.
2281. W. H. Treacher, Blackfriars-road—Imp. in respirators.
2282. A. G. Bradby, Reading, Berkshire—An imp. in connection with collars and ties, or other like articles of dress.
2283. A. Benda, 79, Basinghall-street—Imp. in the manufacture of models of the human and other figures to be used as toys, for tuition, and for other purposes. (A com.)
2284. J. Braby and J. Braby, jun., Bridge House-place, Newington Causeway, Southwark—Imp. in wheels and wheeled carriages to be propelled by steam, horse, or other power, and in apparatus for retarding the same.

Dated 14th October, 1858.

2285. J. C. Ollerenshaw, Manchester—An imp. in "cotton gins." (A com.)
2286. H, Liddle and J. Booth, Tonge, near Middleton, Lancashire—Certain imp. in machinery or apparatus for polishing and finishing yarns or threads.
2287. L. Cowell, Adelphi—Imp. in apparel affording the means for preserving life at sea, and to prevent accidents to persons casually immersed in water.
2289. A. Gordon, Little Fife-house, Whitehall—Imp. for manufacturing cast iron, steel, and wrought iron. (A com.)
2291. T. Ingram, Bradford, Yorkshire—Imp. in means or apparatus for signalling between the parts of a train of carriages.
2293. S. Perkes, Clapham—Imp. in machinery for extracting oil from the cocoa nut and other vegetable matters.
2294. H. Martin, Old Kent-road—Imp. in separating starch from gluten in apparatus used therein, and also in preparing cement from gluten.
2295. G. Baxter, Northampton-square—Imp. in colouring photographic pictures.
2296. T. Archer, jun., Dunston, near Gateshead—Imp. in apparatus for preventing explosions of steam boilers.
2297. S. Diggle, Radcliffe, Lancashire—Imp. in looms for weaving.
2298. W, E. Newton, 66, Chancery-lane—An improved construction of cabin or state room for steam boats and other vessels. (A com.)
2299. J. Lomas, Manchester—Imp. in the production of ornamental fabrics for ladies' dresses.

Dated 15th October, 1858.

2300. R. R. Jackson, Blackburn, Lancashire—Certain imp. in machinery or apparatus for sizeing yarn.
2301. W. Bacon, Prestwich, Lancashire—Imp. in the mode of constructing valves, valve cocks, gates, and stopcocks, which may be used in steam engineering, and for other purposes. (A com.)
2302. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of gloves, and in the apparatus employed therein. (A com.)
2303. T. Moore, Sheffield—Imp. in refrigerators.
2304. S. T. Clarke, 30, Kildare-terrace, Westbourne-park—A mode of crossing bankers' cheques and drafts.
2305. J. Wainwright, Birkenhead—Imp. in respirators.
2306. G. T. Bousfield, Loughborough-park, Brixton—Imp. in machinery for cutting the threads of wood screws. (A com.)
2307. G. F. Wilson, Belmont, Vauxhall—Imp. in preparing compounds containing sulphur for preventing and destroying blight, mildew, and insects.

Dated 16th October, 1858.

2308. L. Marcus, Algiers—An improved reaping machine.
2309. F. J. Coulon and S. G. Giraud, 2, Rue Sainte-Appoline, Paris—Imp. in the process of ornamenting skin and leather.
2310. T. W. G. Treeby, 1, Westbourn-terrace Villas, Paddington—An imp. in breech-loading fire-arms and cannon.
2311. H. Francis, 456, West Strand, Westminster—Machinery for making the springs of surgical trusses.
2313. J. Hick, W. Hargreaves, and R. Harwood, Bolton-le-Moors, Lancashire—Imp. in governors or regulators for prime movers.
2814. P. Jensen, Mount-gardens, Westminster-road, Lambeth—An improved apparatus for governing or regulating the speed of marine engines.
2315. A. Robertson, Lounsdale, Renfrew, N.B.—Imp. in applying starch and similar matters.
2316. A. Dunn, Dalston terrace East—An imp. in preparing marking compounds to be used on linen and other fabrics.
2317. B. Nickels, Mitcham, Surrey—Imp in electric telegraphs.

Dated 18th October, 1858.

2318. W. Clay, Ellesmere, Shropshire—Imp. in combined thrashing and dressing machines.
2319. J. A. Mason, Wirksworth, Derbyshire—Imp. in washing machines and apparatus for wringing and mangling.
2320. W. A. F. Powell, Bristol—Imp. in stopping or closing jars and bottles.
2321. C. West, 15, Mornington street, Camberwell New-road—Imp. in the mode of insulating and covering wire.
2322. R. Tidman, Jermyn-street, St. James's—Imp. in machinery or apparatus for paying out and for raising electric telegraph cables.
2323. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of small chains and links for the same. (A com.)
2324. K. H. Cornish, 17, Chapel-street East, May Fair—A new mode of advertising.
2325. W. E. Newton, 66, Chancery-lane—Imp. in apparatus for lighting gas and other lamps. (A com.)
2326. A. W. Drayson, Capt. R.A., Plumstead, Kent, and C. R. Binney, Capt. R.E., Woolwich—Imp. in submarine telegraphic cables.
2327. J. Smith, Newport, Salop—Imp. in rough-shoeing beasts of draught and burden.

Dated 19th October, 1858.

2329. J. Whitworth, Manchester—Imp. in guns, gun-carriages, and ammunition.
2331. J. Owen and H. Duckworth, Blackburn, Lancashire—Imp. in looms.
2333. J. Richmond, 21, Carlisle-terrace, Fairfield-road, Bow—The construction of valves applicable especially to water meters, and other instruments for measuring fluids, and all hydraulic purposes.
2335. W. E. Newton, 66, Chancery-lane—Imp. in the hanging and arranging of cylindrical conical or spiral steel railroad springs, for railway carriages. (A com.)
2337. R. A. Brooman, 166, Fleet-street—Imp. in propelling vessels. (A com.)
3339. W. Riddle, 1, Westbourne terrace, Barnsbury-park—Imp. in packing or forming merchandise or goods into bales.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2352. E. B. Horn, Massachusetts, U.S.—An improved compensation apparatus for a hair-spring balance for a watch or timepiece.—21st October, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 2, 1858.]

November 1st.

775. P. Brun.
976. R. Illingworth.
984. E. S. Trower.
989. J. Swain and M. Swain.
996. C. D. Archibald.
1000. J. Lawson and T. Robinson.
1014. W. Clark.
1018. J. Bunnett and J. G. Bunnett.
1019. C. J. Carr.
1029. R. Best.
1032. W. Clark.
1036. A. V. Newton.
1043. I. L. Bell.
1054. W. Pare.
1058. R. Halliwell.
1060. J. M. Gilbert.
1070. J. Sharples.
1082. H. Hyde.
1132. M. Henry.
1172. W. E. Newton.
1187. J. Stuart.
1200. T. Dunn and W. Irlam.
1204. J. F. Lackersteen.
1218. J. Schloss.
1300. E. T. Hughes.
1332. G. W. Hart.
1428. W. E. Newton.
1609. C. S. Putnam.
1702. W. A. Gilbee.
1735. J. Houston.
1836. G. Metzler and J. Waddell.
1894. H. Hood.
1934. J. Coates.
2038. J. G. Newberry.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Oct.* 29, 1858.]

October 25th.

2408. G. Riley.

October 26th.

2427. H. E. Drayson.
2429. T. J. Swinburne.
2430. T. S. Grimwade.

October 27th.

2451. R. Cook.

[*From Gazette, Nov.* 2, 1858.]

October 28th.

2470. G. Collier.

October 29th.

2419. W. Naylor.

October 30th.

2437. G. Milner.
2439. W. Taylor.
2442. A. E. L. Bellford.
2452. W. Staufen.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4123	Oct. 14.	Stay Fastener	J. McLintock	Westgate House, Barnsley.
4124	,, 15.	The Horizontal Dome Inkstand	D. W Lovell & A. Wilson	9, Wine Office-court, Fleet street.
4125	,, 15.	Revolving Panoramic Stereoscope	J. Cramb	52, Magdalen-yard road, Dundee.
4126	,, 20.	Improved Bench Vice	Easterbrook & Allcard	Albert Works, Sheffield.
4127	,, 21.	Sprig for Binding Boot and Shoe Heels	H. E. B. Farmer	Northampton.
4128	,, 25.	Brown's Improved Convex Washing Board	C. Brown	Market-place, Leicester.
4129	Nov. 2.	Cinder Sifter	D. Jones	Dartmouth-street, Birmingham.
4130	,, 3.	Hinge	J. Sadler and T. Davis	Birmingham.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 12, 1858.

COUNCIL.

The following Institutions have been taken into Union since the last announcement:—

Leicester, Town and County Church of England Institute.

Woolwich, Charlton, and Plumstead Literary and Scientific Institute.

NOTICE TO MEMBERS.

The One-Hundred-and-Fifth Session of the Society will commence on Wednesday next, the 17th inst. The Chair will be taken at 8 o'clock on the following Wednesday Evenings:—

1858.	November	—	—	17	24	—
,,	December	1	8	15	22	—
1859.	January	—	—	19	26	—
,,	February	2	9	16	23	—
,,	March	2	9	16	23	30
,,	April	6	13	—	27	—
,,	May	4	11	18	25	—
,,	June	—	—	—	—	29*

For the Meetings previous to Christmas, the following arrangements have been made:—

November 17.—Introductory Address on the Opening of the One-Hundred-and-Fifth Session, by the Chairman of the Council, Mr. C. Wentworth Dilke.

*** On this evening the Medals which were awarded by the Council for Papers read at the Weekly Evening Meetings during the last Session, and for articles submitted to the Society's Committees, will be distributed.

* The Annual General Meeting: the Chair will be taken at 4 o'clock. No Visitors are admitted to this Meeting.

November 24.—Mr. F. Joubert. "On a Method of rendering Engraved Copper-Plates capable of Producing a greatly-increased Number of Impressions."

December 1.—Mr. Hyde Clarke. "On Copper-Smelting."

December 8.—Mr. P. A. Halkett. "On Guideway Agriculture; being a System enabling all the Operations of the Farm to be performed by Steam Power."

December 15.—Mr. E. J. Reed. "On the Modifications which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence."

December 22.—Dr. Forbes Watson. "On the Growth of Cotton in India."

ADAMS'S SYSTEM OF PERMANENT WAY.

In February, 1856, an account was given in the pages of this *Journal* of a system of Wrought-iron Permanent Way for Railways, by Mr. W. Bridges Adams, denominated the Suspended Girder Rail. The testimony in its favour by several eminent railway engineers, and the practical experience since gained confirmatory of their opinions, together with its adoption for more than one important line, make it probable that this class of way will be ultimately preferred, wherever iron is considered imperative and timber inadmissible. Experiments are still going on to ascertain the minimum of bearing surface which will suffice, in order to to keep down the weight and cost to the absolutely requisite quantity, and it is probable that a considerable reduction will be the result. For the purposes of export to India this is of great importance, as every ton weight averages thirty shillings for freight—about one-sixth added to the original cost of the materials. And wrought-iron is in all structures a very considerable reduction of dead weight, with equal strength and greater security as compared with cast-iron. The two sections hitherto applied are as follows:—Single-headed (Fig. 1) and Double-headed (Fig. 2).

Fig. 1.

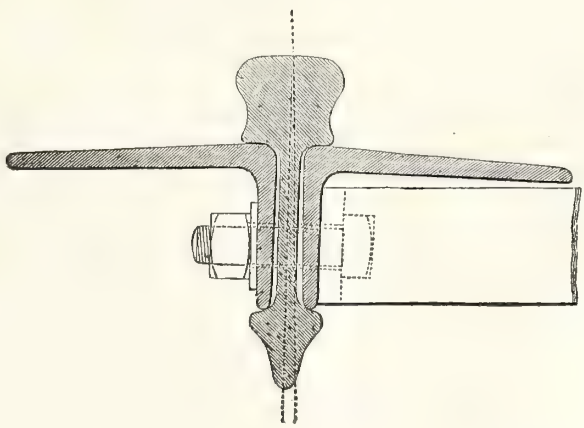
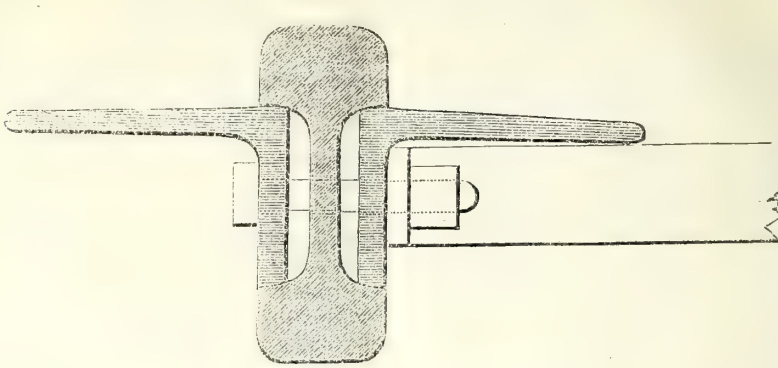


Fig. 2.



Meanwhile two of the highest Indian authorities—the East Indian Railway and the Great Indian Peninsular Railway—appear to consider the question of iron sleepers a most important point, judging from their half-yearly reports. The East Indian engineer states that the cast iron sleepers are a comparative failure, and that they are being removed into branches and sidings, and being replaced on the main line with timber sleepers. The Great Indian Peninsular engineer, on the contrary, states that the destruction of timber sleepers is as ten per cent. compared with five per cent. of the cast-iron sleepers. In the absence of specific information as to the cause of failure, is is to be presumed that the failure of the cast-iron is from breakage—a defect from which the wrought-iron system is free—and the failure of the timber must be either from the white ant or from splitting by moisture and heat.

Structure has, no doubt, much to do with it, both in the case of iron and timber. A bad form of cast iron will ensure breakage even with a surplus amount of weight, and the mode in which timber sleepers are commonly used with double-headed rails, both in England and India, is not favourable either to the durability of the rails or timber.

The timber sleepers are usually ten inches in width, five inches in depth, and from nine to ten feet long. At each end of the sleepers is fixed down, by iron spikes or wood trenails, a mass of cast iron called a chair, now usually varying from 25 lbs. to 42½ lbs. each. In these chairs, the distance of which apart on the sleeper determines the gauge, are fixed the rails, the opening being sufficient to drop them in from above, and they are secured by wooden keys driven in laterally outside. The rail is composed of three members or portions, the lower table, the upper table, and the vertical web, which connects them together. The rail resting in the chair on its lower table acts as a prop to sustain the wheels. If the rails and chairs are always in contact, no blow will ensue, and when the upper table is worn out by work, it may be turned down. and the lower table will supply an unworn surface, with only the defect of a bad bearing in the chair, by reason of the worn surface of what was the upper table. But, practically, the running of the wheels causes lateral blows which crush the wooden keys, and the rails get loose in the chairs, striking a succession of hard blows well-known to passengers, crystallizing the texture of the rails, and destroying their upper surface by the blows of the wheels and their lower surface by blows on the chairs. All this is aggravated by the great elevation of the rails above the bearing of the sleepers on the ballast. The rail is five inches, the chair two inches, and the sleeper five inches, total twelve inches; thus any loosening of the wood key is aggravated by the height of the prop, and a rocking motion ensues which disturbs the bearing of the sleepers, and, in wet weather, lets in the water beneath them. To solidify the sleepers below, it is thus needful to dig out 12 inches of material to get at them, and this leaves loose ballast above when again filled in, which is disadvantageous in many ways. In this particular the wrought iron suspended girder is particularly advantageous. It is not requisite to open up the ground to get at it, and the upper surface is always firm and solid.

The principle of the wrought iron way, *i.e.*, suspending the rail from the upper table instead of propping it on the lower table, has, for a considerable time past, been applied to timber as well as to iron, and for those who think timber sleepers better than iron, the advantages, mechanical and economical, hereby attained, are very great. In the first place, as the rail is suspended by the upper table, it does not need one half the strength of the vertical web, but merely enough to hold the top and bottom tables together, as in an ordinary bridge girder. Consequently, weight can be saved in the rails, and at the same time their depth can be increased. An ordinary rail is five inches in depth, and as the strength of a beam is as the square of its depth 5×5 represent 25, whereas 6×6 represent 36, or one half increase and 7×7 represent 49 or nearly double.

In the side channels of these deep rails are bolted lateral timbers, four inches wide by four inches deep, by key bolts, three feet apart, making a total width of eleven inches. The rail is thus compounded of a central iron bar between two timber bars which give it great lateral strength in addition to its own increased vertical strength.

The lower rails are connected togther at the joints by brackets of wrought angle iron, bolted down to a cross sleeper. If the rails are long, a central cross timber, four inches by four inches is secured to the central key-bolts, and thus the gauge is secured.

In the ordinary cross-sleeper road there is a sleeper every yard, the full area of which is about seven and a half superficial feet, but the practical bearing is generally calculated at less than three-fourths. On the longitudinal plan the whole area may be reckoned, and therefore the area of the suspended plan is fully equal to that of the cross-sleeper plan, while the height of the rail is only four inches above the bearing, instead of twelve inches on the ordinary method.

When this plan was first proposed it was imagined that the small bearing surface of the rail on the timber by which it was suspended would crush in and destroy the timber; but calculation easily demonstrates the contrary. For instance, there are six chairs to an 18-feet rail; the bearing of each chair on the timber sleepers is about 48 square inches—total, 288. in the suspended method there is a width of three-quarters of an inch along each side of the rail, amounting to a total of 320 square inches,—and continuous.

But, it was argued, on the Great Western system of the bridge rail there are 1,080 square inches in the same

length, and yet it crushes into the timber. Quite true, but the reason is obvious. It is a shallow and not a deep rail, and it does not distribute its load over a long space, as does the deep rail. It crushes the timber in detail beneath the wheels.

The engineer of the North London Railway had faith in the system and determined to lay down a few lengths on trial. The total width of the combined rail and lateral timbers was ten inches and a half, and the rails used were not deep, but the ordinary section of five inches—the total depth of the timbers being four inches. The rails were connected at the joints by cast-iron angle brackets secured to cross sleepers, and there was no intermediate tie, the length of rail being only fifteen feet. The result is given in the following report by the engineer:—

"The experimental length of the suspended rail laid on the North London Railway has now been down about twelve months. It was purposely placed in a situation exposed to the severest test which the line admits of, at the foot of a steep gradient, on a sharp curve, and at a station where numerous trains stop and pass through every hour.

"From the weekly reports furnished by the Company's inspectors, combined with my own occasional examination, I am able to state, with confidence, that the result of this trial has been very satisfactory in respect of durability and of economy. The original outlay is less than that required for the ordinary modes of construction, and the cost of manufacture is trifling, while the road is smooth and easy for the traffic."

On the North London Railway engines are used of thirty-five tons weight. Passenger trains are incessant,—goods trains frequent, and with the exception that the speeds are not quite so great as on some other lines, it is one of the hardest worked lines in the world, and the use of breaks is very destructive. On the sample piece of line, the upper table of the rails being actually worn out, they were reversed, when the lower table was found as perfect as when new, and the timber was absolutely free from any wear or movement in those parts where the rail bore on it. When the bolts were taken out the timber remained fast in the recesses of the side channels, and it required force to get it out. It had become, as it were, cemented to the iron.

Since then, a portion has been laid down on the Eastern Counties line—the main line from Cambridge, near the locomotive sheds—where it has been examined by several engineers, and highly approved of. The movement is easier and smoother than on any other part of the line, though only the ordinary rails and not improved rails have been used, and the common sleepers cut down the middle have been used, instead of proper longitudinals.

We come now to the question of cost and comparison.

CROSS SLEEPER LINE.
Quantities in a single mile.

		Tons.	Cwt.		£	s.		£	s.	d.
504 Rails, 21 feet long	70 lbs. per yard, 5 in. deep	110	0	at say	8	0		880	0	0
504 pairs Fishes	22 lbs. per pair	4	19	,,	9	0		44	11	0
2016 Bolts		1	2	,,	20	0		22	0	0
3520 Cast Chairs	28 lbs. each	44	0	,,	5	0		220	0	0
7040 Spikes	1 lb. each	3	3	,,	12	0		37	16	0
3520 Wood Keys				,,	5	0		18	0	0
1760 Cross Sleepers creosoted	5 in. × 10 in. × 9 ft., 4s. 6d. each	130	0					396	0	0
18864 Parts.		293	4					1618	7	0
	Freight to India at 30s. per ton							439	10	0
								£2057	17	0

SUSPENDED RAIL ON TIMBER LONGITUDINALS.

		Tons.	Cwt.		£	s.		£	s.	d.
504 Rails, 21 feet long	65 lbs. per yard, 6 in. deep	102	3	at say	8	0		817	4	0
504 pairs Angle Joints, 1 ft. 6 in. long	28 lbs. per pair	6	6	,,	9	0		56	14	0
1008 Bolts for Angle Joints	$1\frac{1}{2}$ lbs. each	0	$13\frac{1}{2}$	,,	20	0		13	10	0
3520 Key bolts for timber	$2\frac{1}{2}$ lbs. each	4	0	,,	12	0		48	0	0
1008 Angle Joint Spikes	1 lb. each	0	9	,,	12	0		5	8	0
1008 Timber Longitudinals	5 in. × 4 in. × 19 ft. 6 in., 56 loads	42	0	,,	3	10	Load	196	0	0
252 Cross Sleepers	5 in. × 5 in. × 9 ft., 4s. 6d. each	19	0	,,	3	10	do.	56	14	0
252 Wood Ties	4 in. × 4 in. × 4 ft., 2 loads	1	12					7	0	0
8056 Parts.		176	$3\frac{1}{2}$					1200	10	0
	Freight to India at 30s. per ton							264	5	3
								£1464	15	3

The Cross section and Plan of the suspended rail are here given. It will be seen that to remove the rail it is not necessary to remove the timber, but only the joint bolts, both sides being alike. Fig. 3 is the Cross section, Fig. 4 the Plan.

	£	s.	d.
Assuming these prices to be correct, the saving on first cost by the improved system in England is per single mile	£417	17	0
In India, taking the difference in freight, there is a saving of	175	4	6
Total saving	£593	1	6

With a rail of one-half more vertical strength.*

* The timber longitudinals may be applied in shorter lengths, break-joint if preferred.

If the same principle of side bolting be adopted with Cast iron sleepers in the strongest mechanical section, as Fig. 5, the cost per mile will be—

	Tons.	Cwt.		£	s.	d.
504 Rails	102	3	at £8	817	4	0
3520 Pairs cast Side Brackets	100	0	,, 5	500	0	0
4024 Key Bolts, 3 lbs. each	5	8	,, 12	64	16	0
504 Tie Bars, 12 lbs. each	2	14	,, 12	32	8	0
	210	5		1414	8	0
Freight to India 30s. per ton				315	7	6
				£1729	15	6

A sample of this has been applied on the South-Western Railway.

The saving in this mode as compared with the common system will be £326 0s. 0d. Cast-iron can of

Fig. 3.

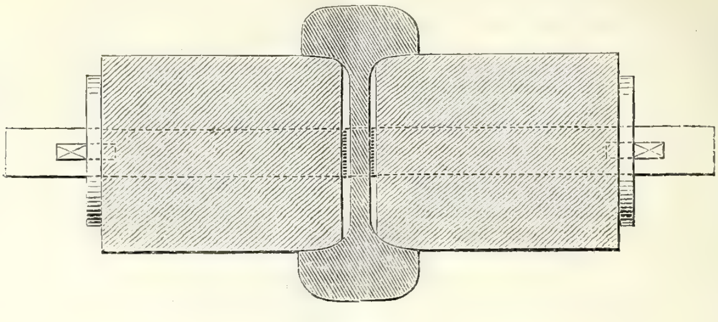


Fig. 4.

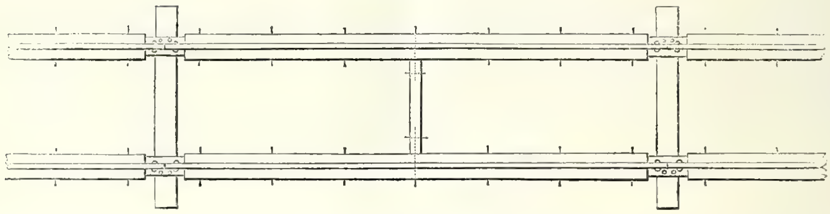
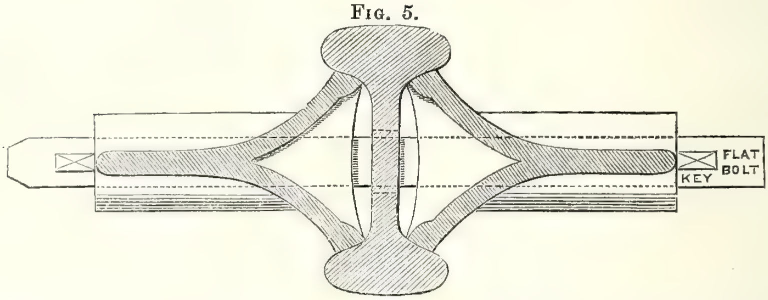


Fig. 5.



course only be used in short lengths, and not continuously like wrought iron. The minimum ultimate cost of the wrought iron way is not yet ascertained, the reduction in scantling being still in course of experiment, but enough has been shown to induce those interested to institute a very searching inquiry into the whole matter.

In using the small scantling of timber, two obvious advantages arise,—lower cost of material, and greater facility for creosoting, if that process be applied. It will bring a simpler and cheaper class of timber into use for railway sleepers. This system is really lower in cost than the American system, which has been adopted from the temporary ways of English contractors, but with the advantages of a double-headed rail of less comparative weight, but really equivalent to two rails, the lower side remaining undamaged while the upper side is wearing out. And in addition to this there is a great saving in the depth of ballast.

The prominent distinction between the American system and the English system, is, that in England a double headed rail is used, secured in a cast iron chair. The cost of these cast iron chairs, and their freight and transit rendered it necessary to dispense with them for poor lines, and in the absence of other knowledge, the double-headed rails was also dispensed with, and the flat bottomed rail of only half the service substituted for it. This new system of side bearers in the channels practically doubles the duration of the rails while diminishing the cost.

In considering the question of freight as an element in all distant Colonial lines when the material is supplied from England, India has been taken as affording the broadest comparison.

Proceedings of Institutions.

Bolton Mechanics' Institution.—The twenty-third annual meeting was held in the Reading-room of this Institution, on Wednesday evening, the 20th ult., when there was a respectable and moderately numerous gathering of the members and their friends. The chair was occupied by G. J. French, Esq., president; and among others present were Mr. Ald. Heywood, Dr. Chadwick, Dr. Haddock; T. Holden and A. Ferguson, Esqrs.; Messrs. John Entwisle, J. H. Raper, I. Barrow, W. Abbatt, A. Ridings, G. Toulmin, Paul Beswick, R. Hadfield, A. Lawson, W. H. Horrocks, J. Waring, &c. The Chairman briefly opened the proceedings, and called upon Mr. Barrow, the acting secretary, to read the report, which, after announcing the gratification of the Committee that the position of the Institution had improved during the past year, both numerically and financially, states that the debt upon the general account has been reduced from £54 12s. 2½d. to £35 18s. 8½d., while that incurred by the removal from Bridge-street to the present premises, which, at the last annual meeting, was

£60 5s. 1½d., is now £30 14s. 9½; so that the entire amount of encumbrance is £66 13s. 6d., which the Committee venture to anticipate may be cleared off, or, at least, very greatly reduced, by energetic and economical management throughout the ensuing year. The number of honorary members is now 98, being a decrease of two upon the preceding year. The number of general members during the past year was—in the first quarter, 320; second, 291; third, 303; fourth, 262; or an average of 294; being an increase of ten on last year. The number who have been admitted to the privileges of the Institution by the transferable cards of honorary members is 78; being an increase of 13; showing altogether a total increase of 21 persons who have participated in its advantages. The reading and news room continues as heretofore to be the most attractive and successful department of the Institution. The library has been increased by the purchase of 59, and the presentation of 19 volumes. Joseph Crook, Esq., M.P., has kindly continued his valuable contributions of Parliamentary documents, which enable the members to refer to the most recent and authentic authorities on political questions. Captain Gray, M.P., has liberally presented 100, and Peter Ainsworth, Esq., 50 copies of the Speeches and Addresses of his Royal Highness the Prince Consort. Through the kindness of F. J. Furnivall, Esq., M.A., a member of the Council of Teachers of the Working Men's College, London, the President has also been enabled to present among the committee and members 80 copies of a valuable pamphlet by John Ruskin, Esq., on the "True Functions of the Workman in Art." The number of volumes now in the library is 4,689, and the issues for the past year have been:—For the first quarter, 3,014; second, 2,867; third, 2735; fourth, 2401; total, 11,017; being a decrease compared with last year of 407 volumes. The following classes have been in operation during the past year. The average number of members is appended to each:—Senior writing and arithmetic, 37; junior, 52; mechanical drawing, 40; landscape, 23; French language, 9; English grammar, 8; essay and discussion, 12; total, 181; an increase of 29 over the number of pupils for the year preceding. About 20 pupils from these classes attended the annual examination held in connection with the Institutional Association, at Manchester, in June last, on which occasion the members of the mechanical drawing class succeeded in bearing away nearly one-third of the certificates awarded in that section, and one member of the arithmetic class was also successful in gaining a certificate. The Committee have abstained during the past year from all hazardous speculations for the amusement of the members, but they have had valuable assistance in gratuitous lectures, which were delivered by the Rev. R. Harries Jones, on "Landmarks of the Reign of Henry Eighth;" the Rev. Samuel Doria, of Wigan, on "The Philosophy of Education;" by the President, on "The History and Manufacture of Stained Glass Windows;" and by Henry Ashworth, Esq., three lectures, being his "Recollections of a Tour in the United States of America, Canada, and Cuba." Mr. Ashworth's lectures will be resumed in the course of the ensuing winter. The annual soirée was held in the reading-room on March 2nd, and was eminently successful. It was attended by about 250 ladies and gentlemen—the utmost number that could be accommodated in the room during tea, but this number was afterwards very greatly increased.—Mr. W. Abbatt moved that the report and financial statement be adopted, printed, and circulated. This was seconded by Mr. Waring, and carried unanimously. Mr. A. Ferguson moved the thanks of the members "to those gentlemen who have aided the Institution during the past year, by donations of money or books, by the gratuitous delivery of lectures, or by giving their services as teachers of classes. Mr. John Entwisle seconded the motion; and, alluding to the teachers of the classes, especially named Mr. Paul Beswick, for the efficient manner in which he had conducted the French class. The resolution was passed unanimously, and Mr. Beswick returned thanks.—The President also acknowledged the compliment, and promised to communicate the resolution to the other gentlemen to whom it referred. Mr. Ald. Heywood said he had great pleasure in moving—"That the members hereby express to Gilbert James French, Esq., their cordial and hearty thanks for his valuable services as president of the Institution, and their desire that he will consent to retain his position for the ensuing year." Dr. Chadwick seconded the resolution, which was carried by acclamation. The President said he felt very much gratified at the kind expression of their satisfaction with his services as president during the past year. He should have been very glad indeed to have relinquished the office now; but it had been urged upon him, and there were some few reasons why he might be more useful in the coming year than one newly elected. He therefore consented to retain the office another year, with the understanding that, at the expiration thereof, he should not be asked to again accept it. He took that opportunity to inform the meeting that arrangements were in progress for a series of lectures to be delivered in that room during the ensuing winter. Mr. H. Ashworth would resume his instructive and delightful "Recollections of his Tour in the United States, Canada, and Cuba." The lectures conveyed so much agreeable information that he was sure they would look forward with pleasing anticipation to the commencement of the year, about which time Mr. Ashworth hoped to resume them. The Rev. R. Harries Jones had promised to read a paper on the "Affinity of European Languages," and Thomas Barnes, Esq., had kindly consented to give them the benefit of his practical observations gathered together during his residence in some of the principal towns of Italy during last winter. Thomas Ballantyne, Esq., proprietor and editor of the *Statesman*—a London journal, independent of any of the political parties of the day—had kindly offered to prepare and read a non-political lecture on "The best means of using a public library." Robert Heywood, Esq., one of the oldest and staunchest friends of the Institution, had promised to look over the note-books he had kept during his travels, and give such portions of them as he might think interesting and useful. Dr. Chadwick, so well known to all, whose philanthropy was equalled only by his professional skill, had been prevailed upon to promise papers on some scientific subjects of real practical interest and value. That to be first treated of was "Water, its composition and impurities." Should the members take the interest in this and kindred subjects of physical science which their importance deserved, he hoped that Dr. Chadwick might be induced to extend his papers to other branches of domestic and household science. The Rev. H. Powell, vicar of Bolton, promised to deliver a lecture on his "Personal recollections of the Island of Ceylon, its natural productions, agriculture, inhabitants, religion, &c." For his own part, if agreeable to them, he proposed to read something about the life and times of the late Samuel Crompton, a Bolton worthy, less known than he ought to be to the present generation of his townsmen. He was not without hope that other gentlemen might be induced to give similar aid to the Institution, and also that a system of exchanging lectures with some of the Institutions in neighbouring towns might eventually be arranged, by which they might be able reciprocally to benefit each other. All, however, depended on the reception given to the lectures by the members. Hitherto it had been the custom to invite the general public to attend lectures and entertainments got up by this Institution, charging a small sum for the admission of such persons as were not members. No practical advantage had been derived from this arrangement, the receipts being usually so small as to be unworthy of notice; while there was a difficulty at a crowded meeting in knowing who were and who were not members. It was therefore suggested whether it might not be better to confine the admission to the lectures of the ensuing season to the

members of the Institution only, or to entitle each member to introduce one lady. Mr. Richard Hadfield moved a resolution to this effect, which was seconded by Mr. A. Lawson, and carried unanimously. Dr. Haddock moved a vote of thanks to the vice-presidents, trustees, officers, and retiring committee, which was seconded by Mr. W. H. Horrocks, and carried unanimously. After some discussion the officers and committee were elected for the ensuing year, and the meeting closed with a vote of thanks to the president for his services in the chair.

CHICHESTER LITERARY SOCIETY AND MECHANICS' INSTITUTE.—The members of this Society held their annual meeting in the Lecture-hall at Southgate, on Wednesday morning, the 6th October, when there was a large attendance. William Gruggen, Esq., having been called to the chair, the secretary (after some routine business) read the report from the retiring committee, from which it appears that this Institution continues to maintain its hold upon public favour, as the present number of members, 514, sufficiently demonstrates. It was stated that not fewer than 1,313 persons had inspected the museum during the past year, this collection, through the skill and attention of Mr. Hills, the curator, forming one of the most interesting features among the objects of interest in the city. Mention was next made of the principal donations recently received, particularly those of Walter Mantell, Esq., consisting of a quantity of fossil bones of an extinct species of gigantic birds from New Zealand. In regard to the library, the condition of the books, and the addition recently made, the report speaks favourably. The circulation during the past year had nearly reached the number of 10,000 volumes, including a large proportion of educational and instructive works. The report then adverted to the attempt made some months since to establish a reading and news-room, assigning as the cause of its failure the lukewarmness and indifference of the persons—the apprentices and working men—for whose benefit it was more especially designed. Having referred to the success which attended the past session of lectures, a confident hope was expressed that the series in course of delivery would prove highly attractive as well as instructive. The report concluded by gratefully acknowledging the deep obligation the Society is under to Mr. Gauntlett, "whose energy and zeal, as secretary to the Institution, have so greatly contributed to its continued prosperity." The financial statement exhibited an income of £275 1s. 4d., with an expenditure of £277 10s. 1d., leaving a balance due to the treasurer of £2 8s. 9d., a result attributable to the large outlay incurred by the publication of a new catalogue of the library, on which only a comparatively small return has been hitherto received. On the appointment of officers for the year ensuing, his Grace the Duke of Richmond was re-elected president; the Rev. John Fullager, Dr. Tyacke, and Messrs. B. Adams, and W. Gruggen, vice-presidents; H. W. Freeland, representative to the Society of Arts; Mr. G. Paull, treasurer; Mr. T. Pescod, honorary curator of apparatus; Mr. J. Gauntlett, secretary; Messrs. Barnard and Allen, auditors; and the following gentlemen members of the committee:—Rev. W. Watkins, and Messrs. Allen, Arnell, Biffin, Charge, Dale, Fuller, Jones, Mittin, Molesworth, Pullinger, Purchase, Roper, Rodgers, Sawyer, Seaman, Spring, and E. Wyatt. The thanks of the meeting were voted to W. Mantell, Esq., for his valuable donations to the museum; to Messrs. Baxter, of Lewes, for a complete series of the *Sussex Express*, in twenty-one handsomely bound volumes; to the gratuitous lecturers during the past year; and to Mr. Freeland, for his services as representative to the Society of Arts. A vote of thanks to the chairman closed the proceedings. On the evening following, the opening lecture of the session was delivered by Professor Creasy, M.A., on "The Scientific and Practical Study of History," when the learned gentleman, in an able and eloquent discourse, after defining the meaning of the term "History," pointed out the proper limits and objects of historical inquiry, and entered at considerable length into the best methods of acquiring a comprehensive and accurate knowledge of this subject. There was a numerous attendance, and at the close a vote of thanks to the lecturer was carried by acclamation. And, on the evenings of the 19th and 20th inst., Dr. G. Kinkel lectured on "Art during the Middle Ages, from the Norman Conquest to the Reformation," when he gave very great satisfaction to crowded assemblies of the members.

LOCKWOOD (MECHANICS' INSTITUTE).—The third quarterly meeting of the members and friends of this Institute was held on Saturday evening, 9th October. Bentley Shaw, Esq., J.P., president, occupied the chair. On and around the platform were the Revs. J. B. Bensted, M.A., and J. R. Jagoe; Messrs. C. Kaye, J. Brierley, J. Crosland, J. W. Spedding, G. Shaw, S. Black, T. Haigh, S. Beaumont, S. Lodge, J. Shaw, &c., &c. An interesting paper on "Progress: or the Life of George Stephenson," was read by Mr. Nathan Jagger. The chairman remarked that the paper showed great research, and was calculated to effect much good. Recitations were given by the members; and the singing-class, assisted by Mr. Allan Lee, and accompanied on the harmonium by Mr. Bartimeus Robinson, executed several pieces of music. The certificate awarded by the Society of Arts to John Brammer, for proficiency in arithmetic, was presented to him by the president, who expressed himself much gratified with the dilligence and attention evinced by the candidate. He hoped to see many members of the Institution follow in the same steps, and concluded by advising the candidate to resolve firmly to persevere in the course he had begun. Votes of thanks were given to the lecturer, the singers, the reciters, and the chairman, after which the proceedings terminated.

MEETINGS FOR THE ENSUING WEEK.

MON.......British Architects, 8.

TUES. ...Statistical, 8. Rev. C. B. Robinson, "On the Statistics of Prices in the Peculiar of Snaith, Yorkshire, in the Sixteenth, Seventeenth, and Eighteenth Centuries."
Civil Engineers, 8.

WED. ...Society of Arts, 8. Mr. C. Wentworth Dilke, Chairman of Council—Address on the opening of the 105th Session.
Geological, 8. I. Dr. Rubridge, "On some points in the Geology of parts of South Africa." II. Mr. Stow, "On some Fossils from South Africa."

THURS....Chemical, 8. I. Mr. Kynaston, "On some Analyses of the Malvern Waters." II. Messrs. Perkin and Duppa, "On Bibromacetic Acid." III. "On the Atomic Weights of the Elements."
Linnæan, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 5, 1858.]

Dated 27th September, 1858.

2160. X. Boutteville, Paris—An improved neckcloth or tie, means of connecting ties to collars and bands, and an improved collar. (A com.)

Dated 14th October, 1858.

2288. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in the manufacture of articles of hard vulcanized india-rubber, gutta-percha, and similar gums. (A com.)

Dated 19th October, 1858.

2330. W. F. Batho and E. M. Bauer, Salford—Imp. in screws, worms, and wheels, and in machinery or apparatus for cutting the same.
2332. A. Allan, T. Whimster, and R. Gray, Perth—Imp. in steam boilers, also applicable in part to gas meters, lamps, and lubricating and other apparatus requiring a constant liquid level, and in part to pressure-indicating apparatus.
2334. W. E. Newton, 66, Chancery lane—Imp. in apparatus for washing clothes and other articles. (A com.)
2338. Capt. J. Grant, Hyde-park-street—Imp. in constructing and arranging ovens suitable for baking bread.

Dated 20th October, 1858.

2340. L. Stiebel, London, and C. F. O. Glassford, Greenwich—Imp. in machinery for moulding washing blues and other materials while in a plastic state.
2341. R. D. Clegg, Manchester—Imp. in screws.
2343. R. Griffiths, 69, Mornington-road, Regent's-park—Imp. in baths.

2344. T. Twells, Nottingham—Imp. in machinery for embroidering or ornamenting woven, looped, or laced fabrics.
2345. J. Wainwright, Birkenhead—Imp. in ventilating houses and other places.
2346. S. T. Clarke, 30, Kildare-terrace, Westbourne-park—Imp. in apparatus for crossing bankers' cheques and drafts.

Dated 21st October, 1858.

2347. C. C. Alger, Parliament-street, Westminster—Imp. in cupola furnaces.
2348. J. Marland and S. Marland, Sun Vale Iron Works, Walsden, Lancashire—Certain imp. in power looms.
2349. P. Clerc and A. Piaget, 4, Newcastle-place, Clerkenwell—An improved method of winding watches, chronometers, and time-pieces, without the use of a separate key.
2351. J. M. Napier, York-road, Lambeth—Imp. in printing presses and printing machines.
2353. G. Redford, Moseley, Worcestershire—A circular and self-acting cartridge pouch.
2354. J. Baldwin, jun., Birmingham—Imp. in files or holders for papers, letters, bags, and other similar articles.
2355. R. A. Brooman, 166, Fleet-street—Imp. in knitting frames. (A com.)
2356. R. A. Brooman, 166, Fleet-street—Imp. in apparatuses for regulating the supply of fluids. (A com.)
2357. R. A. Brooman, 166, Fleet-street—Imp. in cocks, taps, and other apparatuses for regulating the flow of fluids. (A com.)
2358. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for lubricating railway axles and other bearings. (A com.)

Dated 22nd October, 1858.

2359. J. Burridge, 151, Great Portland-street—Imp. in fire-lighters.
2361. J. Bagnall and W. Bagnall, Westbromwich, Staffordshire—An imp. in the manufacture of iron.
2362. A. Shaw, The Earle's Field Works, Grantham, Lincolnshire—A new method or mode of raising nap on the linings of sheep skins.
2363. R. Waller, 50, Baker-street, Portman-square—Imp. in obtaining motive power, and in apparatus connected therewith.
2364. R. Kennedy and J. Armstrong, Lisburn, Ireland—An improved kiln for drying grain.
2365. C. Clay, Walton-grange, Wakefield—Imp. in apparatus for harrowing, scarifying, and cultivating land.

Dated 23rd October, 1858.

2366. Edwin Palmer and Edward Palmer, Thetford—Imp. in machinery or apparatus for cutting hay, straw, or other similar substances.
2367. P. C. Stortz, Havelock-buildings, Bold-street, Liverpool—An imp. for taking life-size pictures from smaller pictures, either with or without the aid of photography.
2368. E. C. Shepard, Jermyn-street, Westminster—Imp. in electric lamps. (A com.)
2369. R. Bodmer, 2, Thavies-inn, Holborn—An improved toy or plaything for children. (A com.)
2370. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in weaving. (A com.)
2371. J. C. Martin, Fern-cottage, Charlewood-road, Putney—An imp. in the manufacture of metal moulds for moulding plastic substances.
2372. W. E. Newton, 66, Chancery-lane—Imp. in pumps. (A com.)
2373. W. E. Newton, 66, Chancery-lane—Imp. in telegraphic apparatus. (A com.)

Dated 25th October, 1858.

2374. E. Cottam, Lower Belgrave-place, Pimlico—Imp. in the internal fittings of carriages.
2375. M. Mason, Manchester—Imp. in elevating stands or stages for the use of hosemen in extinguishing fires, also for decorating windows, public buildings, and other purposes.
2376. J. J. Welch and J. S. Margetson, Cheapside—Imp. in the manufacture of scarfs for gentlemen's wear.
2377. Capt. Fowke, R.E., Park-house, South Kensington—Imp. in umbrellas and parasols.
2378. J. Robb, Aberdeen—Imp. in propellers for ships and boats.
2379. T. Ashworth and J. Ashworth, Pendleton, Lancashire—Certain imp. in power-looms for weaving.
2380. W. Craddock and J. White, Archer-street, Saint James's—Imp. in the connecting links of harness hames.
2381. G. Kent, High Holborn—An improved churn. (A com.)
2382. A. V. Newton, 66, Chancery-lane—An imp. in the manufacture of candles. (A com.)
2383. S. R. Parkhurst, New York, U.S.—Imp. in cotton gins.

Dated 26th October, 1858.

2384. M. Mason, Manchester—Imp. in self-acting feeding machines, or apparatus for all descriptions of steam or other letter-press printing machines or presses.
2386. C. Wieland, Warkworth-terrace, Commercial-road, Limehouse—Certain imp. in chronometers, watches, and such like timekeepers.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 5, 1858.]

November 5th.

1005. J. S. Willway.
1007. W. Heap.
1008. E. J. Scott.
1009. H. Ashworth.
1015. J. Wright.
1024. J. J. Field.
1033. J. T. Robson.
1041. W. H. Ogden.
1145. F. G. Underhay and J. L. Clark.
1193. C. Cowper.
1195. V. L. Vodoz.
1293. D. Irons.
1313. T. W. Mellor and W. Jamieson.
1481. H. W. Wimshurst.
1987. W. Warne.
2007. W. P. Piggott and S. Beardmore.
2013. S. Hoga, W. P. Piggott, and S. Beardmore.
2023. W. Tucker.
2087. A. H. J. Bastable.

[*From Gazette, Nov.* 9, 1858.]

November 9th.

1046. W. G. Taylor.
1047. J. B. Pim and C. Payne.
1052. E. Fairburn.
1053. J. Soutter.
1055. A. Parkes.
1056. A. Parkes.
1063. L. Durand.
1064. M. Diosy.
1066. J. A. Clarke.
1071. R. Knight
1075. W. S. Bailey and W. H. Bailey.
1079. A. M. Dix.
1090. J. Macintosh.
1199. C. Stanley and J. Fittall.
1463. J. Shaw.
1464. J. Shaw.
2085. G. C. Grimes.
2098. J. R. Scartliff.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Nov.* 5, 1858.]

November 1st.

2450. J. Patterson.
2486. W. Gardner.
2486. A. C. L. Devaux.
2532. A. V. Newton.
2552. J. Homan.

November 3rd.

2487. R. A. Brooman.
2509. W. Lund and A. Bain.

[*From Gazette, Nov.* 9, 1858.]

November 4th.

2561. J. Burrows.

November 5th.

2492. R. Threlfall and J. Higson.

November 6th.

2503. W. Davis.
2504. Louis Benoit Advielle.
2512. H. J. Betjemann.
2597. G. Collier and J. W. Crossley.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4131	November 4.	Well Bucket	Edward P. Capper	West Maitland, New South Wales, Australia.

LIST OF PRESENTS.

The following presents have been made to the Society during the past year. The thanks of the Society have been forwarded to the donors.

PRESENTS.	DONORS.
Specifications of Patents up to the present time, and Indexes	Commissioners of Patents.
Abridgments of ditto	,,
Commissioner of Patents' Journal ..	,,
Synopsis of the Patent Laws of various Countries, by Alexander Tolhausen, Ph. D....................	The Author.
Memoirs of the American Academy of Arts and Sciences, Vol. vi......	Academy.
Proceedings of ditto, pp. 185–248...	,,
Transactions of the American Philosophical Society, Vol. ii., p. 1 ...	Society.
Proceedings of ditto, Vol. vi., No. 56	,,
Transactions of the Academy of Science of St. Louis, Vol. i.	Academy.
Report upon Public Schools and Education in Rhode Island, U.S.	E. R. Potter.
Proceedings of the Academy of Natural Sciences of Philadelphia for 1857................................	Academy.
History of Wisconsin, by W. R. Smith, Wisconsin....................	Wisconsin Historical Society.
1st and 2nd Annual Report of the Wisconsin Historical Society	,,
Maddison, Wisconsin: its Growth, Progress, Condition, Wants, and Capabilities, by Lyman C. Draper (4 copies, with maps)	,,
Annual Report of the Geological Survey of Wisconsin, by J. G. Percival................................	,,
City of Waterton, Wisconsin: its Manufacturing and Railroad Advantages, &c.	,,
United States Patent Office Reports for 1855. Mechanics, 2 vols.; Agriculture, 1 vol.	U.S. Patent Office.
Barnard's American Journal of Education, Vol. i., 1856	Hon. H. Barnard.
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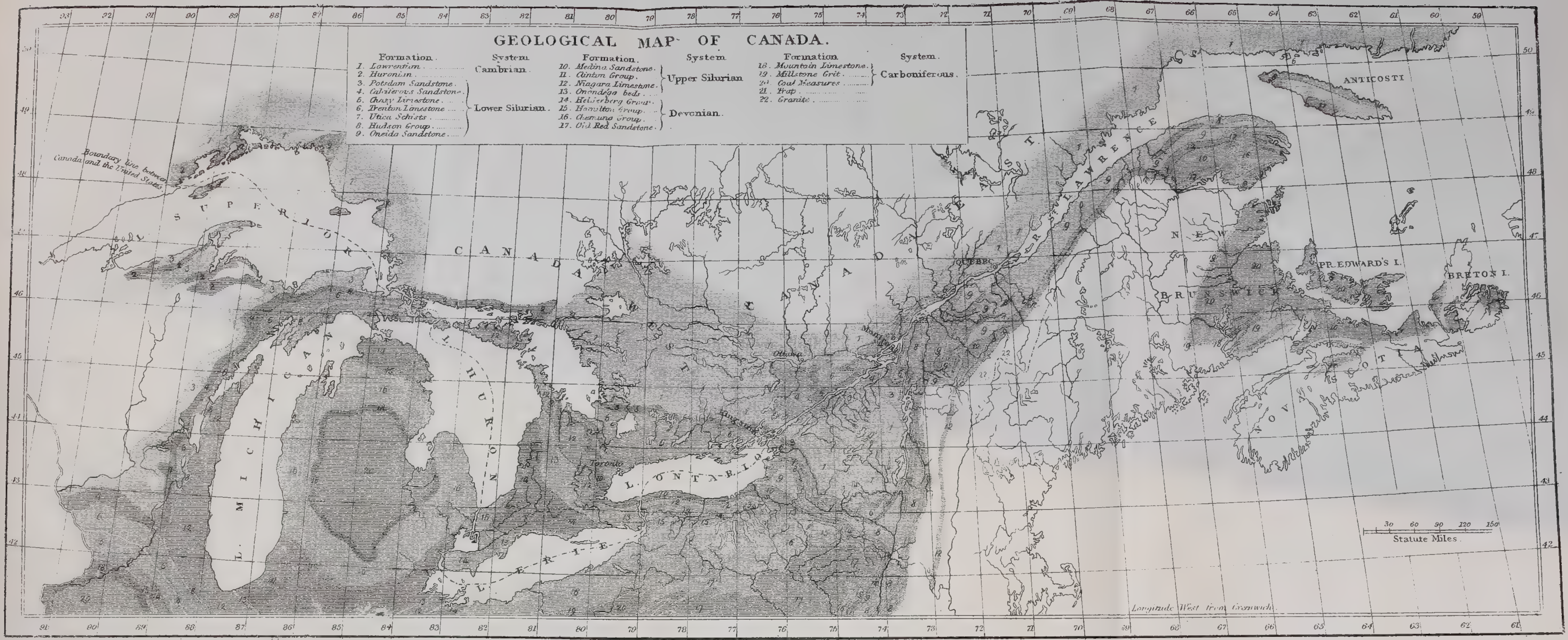
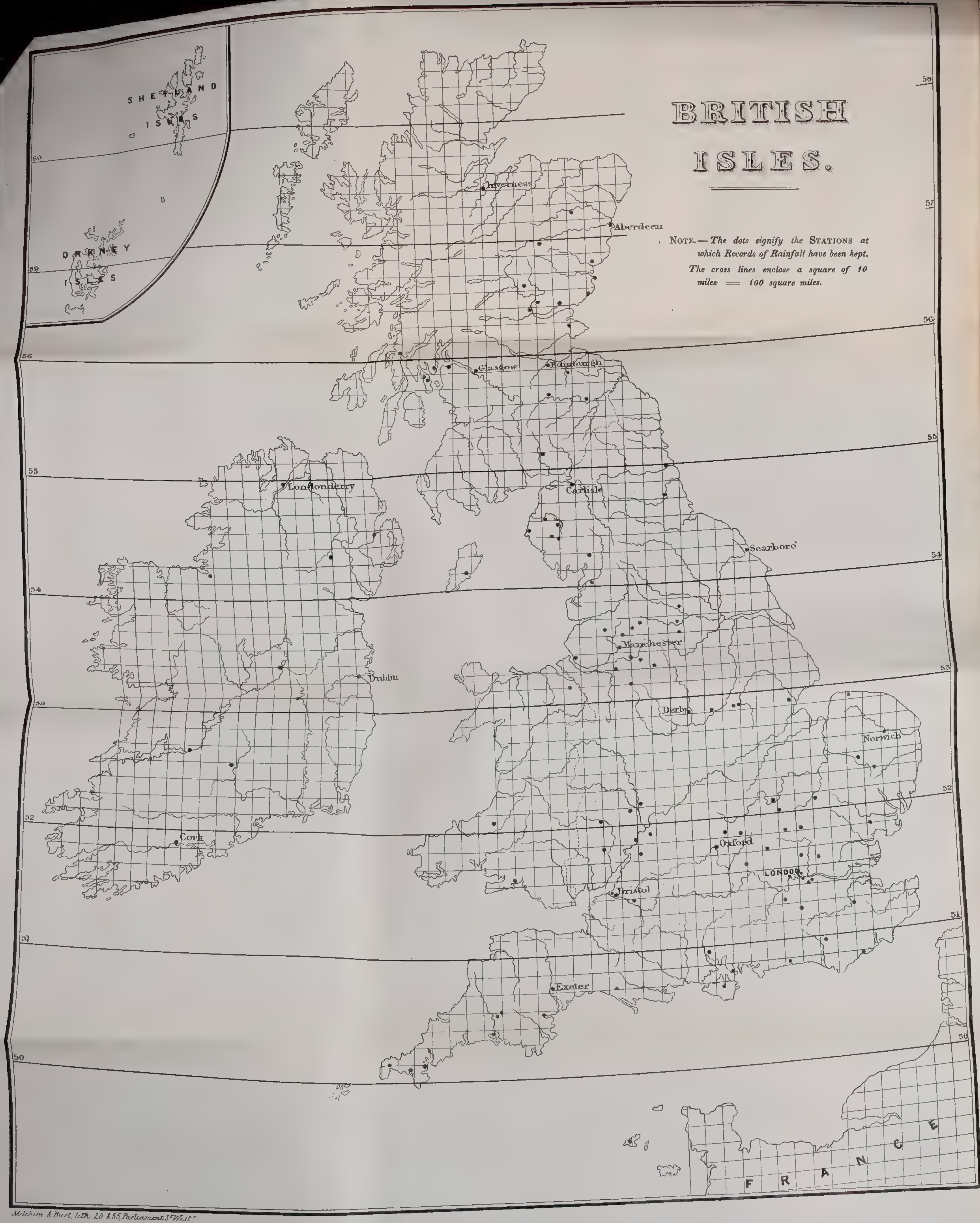
ERRATA.

Page 162, col. 1, line 56, for "Guilt" read "Gwilt;" and for "315" read "316."
,, 162, col. 2, line 40, for "waste" read "water."
,, 163, col. 2, line 13, for "752" read "52.'
Page 206, col. 1, line 16, for "Niele" read "Wiele."
,, 541, col. 2, line 45, for "Polynimials" read "Polynomials."
,, 684, col. 2, line 46, for "70" read "735."
,, 684, col. 2, line 46, for "50" read "506."



GEOLOGICAL MAP OF CANADA.
Formation. System.
1. Laurentian. Cambrian.
2. Huronian.
3. Potsdam Sandstone.
4. Calciferous Sandstone.
5. Chazy Limestone.
6. Trenton Limestone. Lower Silurian.
7. Utica Schists.
8. Hudson Group.
9. Oneida Sandstone.
10. Medina Sandstone.
11. Clinton Group. Upper Silurian.
12. Niagara Limestone.
13. Onondaga beds.
14. Helderberg Group.
15. Hamilton Group. Devonian.
16. Chemung Group.
17. Old Red Sandstone.
18. Mountain Limestone.
19. Millstone Grit. Carboniferous.
20. Coal Measures.
21. Trap.
22. Granite.
Boundary line between Canada and the United States
ANTICOSTI
CANADA WEST
CANADA EAST
L. SUPERIOR
L. MICHIGAN
L. HURON
L. ONTARIO
L. ERIE
ST. LAWRENCE
NEW BRUNSWICK
NOVA SCOTIA
PR. EDWARD'S I.
BRETON I.
Quebec
Montreal
Ottawa
Kingston
Toronto
Statute Miles
Longitude West from Greenwich



Malcolm & Burt, lith. 20 & 55, Parliament St. West.

Society for the Encouragement of Arts, Manufactures, and Commerce.

ADELPHI, LONDON.

ONE-HUNDRED-AND-FOURTH SESSION, 1857-58.

CATALOGUE

OF THE

TENTH EXHIBITION OF INVENTIONS.

Being Appendix I. to Vol. VI. of the "Journal of the Society of Arts."

LONDON:
PRINTED BY W. TROUNCE, 9, CURSITOR STREET, CHANCERY LANE.
1858.

CATALOGUE

OF THE

TENTH EXHIBITION OF INVENTIONS,

BEING A COLLECTION OF ARTICLES RECENTLY INVENTED, PATENTED, OR REGISTERED,

EXHIBITED AT THE SOCIETY'S HOUSE DURING THE SPRING OF 1858.

N.B.—The Council wish it to be understood that they are not responsible for any of the statements contained in this Catalogue.

ENGINEERING, MINING, RAILWAY MECHANISM, &c.

(*For the remainder of the Articles in this Section, see Drawings.*)

1. Patent Reciprocating Furnace Bars; John Chanter, Bromley St. Leonard's, Bow-road, E.

These bars are moved to and fro by a hand lever, fixed to a rocker, which cleans the entire surface of the grate without opening the furnace door. The bars are made in both single and double lengths, as shown in the accompanying illustration of a furnace fitted with the latter kind. The dead plate is formed with slits or openings, which, upon the bars being worked backwards and forwards, are opened and closed, thus giving a sufficient supply of air to the furnace, at the moment the coals are temporarily disturbed for clearing the grate, so as to cause perfect combustion, and prevent smoke.

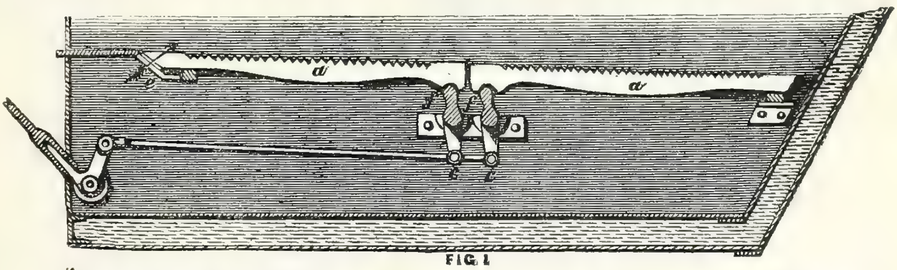


FIG. 1

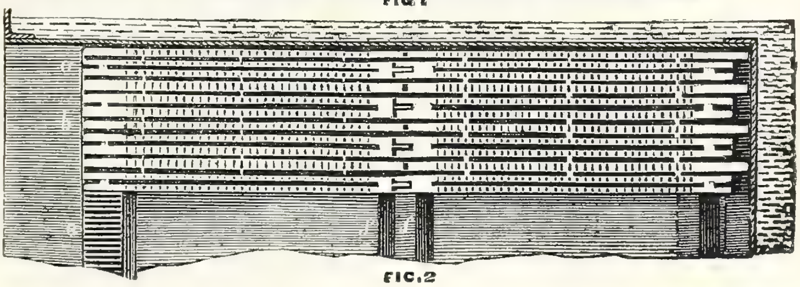
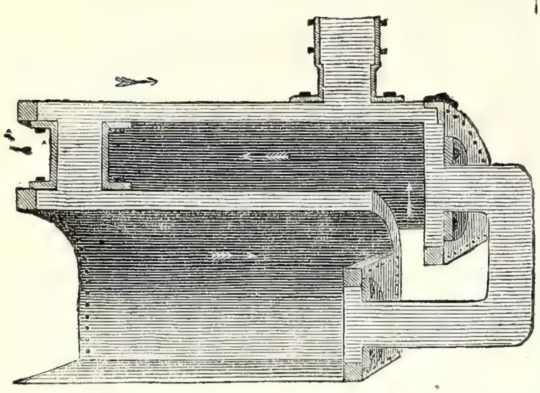
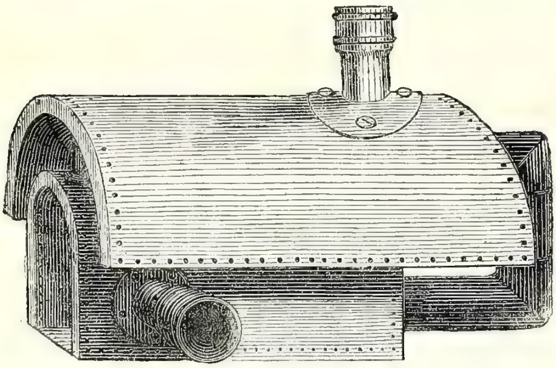


FIG. 2

2. Patent Double-backed Double Boiler; G. and W. Steell, Richmond, Surrey, S.W.

This boiler is formed of two half cylinders, with backs, the top one being longer than the bottom one, and so much larger as to leave a flue between the cylinders; the first cylinder contains the fire, which plays on the back of the bottom part of the boiler, after which it acts on the back of the second, and passes through between the cylinders and returns over the top, by which time the heat is totally exhausted. The two cylinders are attached by the pipe in front between the two, and the backs by a pipe which joins them together, giving all the circulation possible. The socket flange on the top is for the flow, and those at the sides for the return.





3. Steam Boiler; Taylor and Rolfe, Northill, Bedfordshire.

This boiler has a water chamber within the capacity of the flue, and communicating with the outer boiler by means of pipes, extending from the bridge backwards, concentric with the flue, with space all round for the products of combustion. It may be cylindrical or annular, with flue passage through it, or it may be multitubular. The furnace bar frame is hollow, slides in from the front, communicates with the boiler, and is in a piece with the bridge, which is also hollow; the bars are also hollow, and connect the furnace bar frame with the bridge. The water circulates through these hollow parts freely. (See the *Engineer*, Sept. 25th, and Oct. 23rd, 1857.)

4. Patent Feed-water Heater for Steam Boilers; John Randolph Sees, New York. Exhibited by Davies and Hunt, 1, Serle-street, Lincoln's-inn, W.C., and Glasgow.

The feed-water passes through a coil of pipes placed in the breeching or in the smoke box of the boiler, and thus becomes heated; this is stated to effect a saving of 25 per cent. in fuel. There is a check-valve which allows of the circulation being kept up when the feed-pump is not at work.

5. Improved Copper Circulating Tubular Boiler; C. Askew, 27½, Charles-street Hampstead-road, N.W.

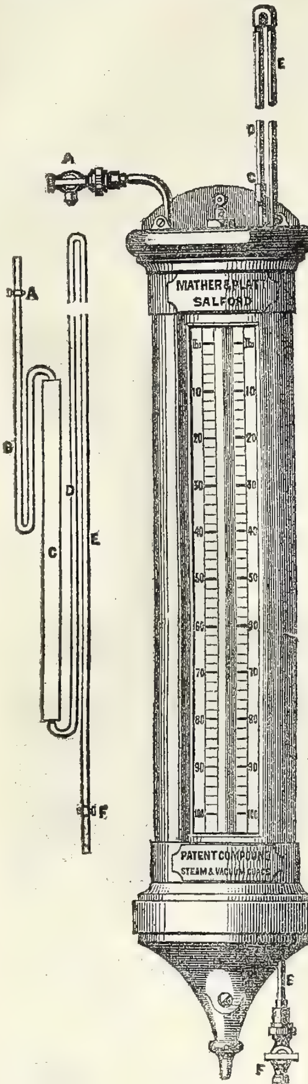
6. Safety Apparatus for Steam Boilers; W. Mann, City of London Gas Light and Coke Company, Dorset-street, Salisbury-square, E.C.

The object of this invention is to modify the arrangement of the ordinary high and low-water guage cocks in such a manner as to keep a constant check upon the person in charge of the boilers, and to cause at intervals, say of half an hour, a pointer to indicate whether the cocks have or have not been examined at such intervals. The guage cocks (in this case three) are connected by a pipe, the upper end of which leads to the pressure cylinder of the registering apparatus containing a piston and spring, which spring only allows the piston to move in proportion to the pressure it receives from the steam; consequently the point of the pencil or tracer is preserved at a distance from zero corresponding to the number of pounds pressure, until the stoker uses the guage cocks to ascertain the quantity of water in the boiler; he commences by shutting off the upper one of the three, and opening the discharge cock on the lower end of the pipe; this allows the steam contained therein to rush out, and the spring to return the piston to a position that brings the pencil to zero. After the stoker has satisfied himself that the quantity of water is sufficient, he shuts the discharge cock, opens the upper one, and the pencil returns to the line of pressure as before; his attention to the same being recorded at the time by the radial line drawn by the pencil.

7. Patent Mercurial Compound Steam and Vacuum Guage; Mather and Platt, Salford Iron Works, Manchester.

In this guage the mercury in the glass tube balances the mercury in the rising column when the pressure is on. One characteristic of this invention is, that it is *self-detecting* of its own accuracy at any moment it is desired to test it. Thus, suppose the steam-tap open, the pressure indicated 30lbs.; close the steam-tap, and the mercury will at once rise to zero; if not, the difference is at once seen. Now open the tap leading to the condenser, and you get the vacuum in lbs.,—say 13lbs. Now open the steam-tap, and you will have indicated 43lbs.,—30lbs. steam, and 13lbs. vacuum. By this means the number of horse-power might be shown on the scale of the guage, where the speed of the engine is uniform and the area of cylin-

der calculated for, if the steam be taken between the throttle valve and cylinder.



(A) Steam inlet three-way tap. (B) A small syphon to contain water to prevent steam coming in direct contact with the glass tube (C). (D) the rising column for the mercury to ascend as the pressure increases (this column must be 2 inches long for each pound pressure). (E) Tube leading from the top of the column to the condenser. (F) A three-way tap, so that when it is closed to the condenser it may be open to the atmosphere to allow a balance of mercury.

8. Pressure Guage; J. Allen, Boston, U.S.A. Exhibited by W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

The peculiarities of this guage are the combination of a piston and flexible diaphragm, with a bow or hoop spring and rack and pinion; the use of a cup-shaped flexible diaphragm, contained within a spheroidal chamber for giving motion to the indicator, and the use for the same purpose of a helical spring, of a dome or cup shape, in combination with a capsule of vulcanized india-rubber. These guages may be applied either as vacuum or pressure guages.

9. Hot or Cold Blast Indicator or Pressure Guage; Joseph Cadman, Bridgend, Glamorganshire.

This instrument is intended to indicate the blast at the furnace tuyere, as well as the loss from leakage, &c., in the air pipes. This is effected by a valve in connection with a steelyard, graduated and weighted in the usual manner.

10. Blast Whistle with Weights; Joseph Cadman.

In this instrument the weights on the valve stem represent the lbs. pressure, or pillar of blast required by the manager, and the whistle is so arranged as to sound the alarm only when the blast is less than the required pressure, and thereby becomes a tell-tale against the engineer.

11. Improved Steam Engine Governor; Brown and May, North Wilts Foundry, Devizes.

12. Metal Steam Cocks, Whistles, Water Guages, and other Cocks, with recent improvements in construction. Perreaux and Co., 39, Mark-lane, E.C., and T. Suffield and Co., Bermondsey-wall, S.E.

13. Patent Self-acting Safety Valve and Spigot. Daniel D. Daly, Tuckey-street, Cork.

This valve consists of a cylindrical flanged cap, the bottom of which serves as the seat of the valve, which is pressed into its place by a spiral spring fitting round the stem and forced downward by a cap screwed into the upper end of the cylinder, having two small holes bored through it. The stem of the valve rises above this cap, and has an eyelet hole to admit the end of a lever for the purpose of raising the valve externally to admit air.

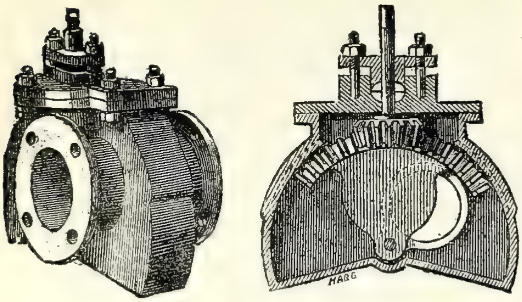
14. Slide Valve; W. E. Ellis, Vulcan Foundry, Warrington.

Valves are placed between the steam and exhaust ports in this slide valve, which are worked by the admission of the steam by the slider. In consequence of this there is no premature compression or exhaustion, however great the lap may be, and the exhaust is thrown fully open at once.

15. Patent Sluice Valve; Brown and May, North Wilts Foundry, Devizes.

This sluice cock is opened by a bevel pinion working into a toothed rack, cast on the back of the sluice, and is constructed so that one turn of the spindle will completely open it. When closed, the faces (either brass or iron)

are forced into contact by a wedge on the back of the sluice.



16. Hydrant, for Connection with Street Mains; W. S. Wheatcroft, 34, Brazenose-street, Manchester.

17. Model of Hydrant, showing the action of the disc, and the form of the valve; W. S. Wheatcroft.

The vulcanized packing-spring on this model has been subjected to compression and immersion in water for eight days.

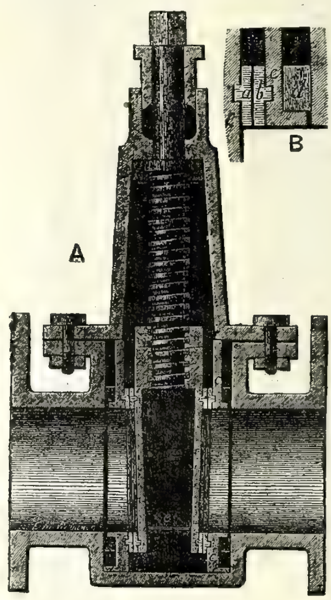
18. Model of Water Tap; W. S. Wheatcroft.

This tap has a valve similar to the above hydrant.

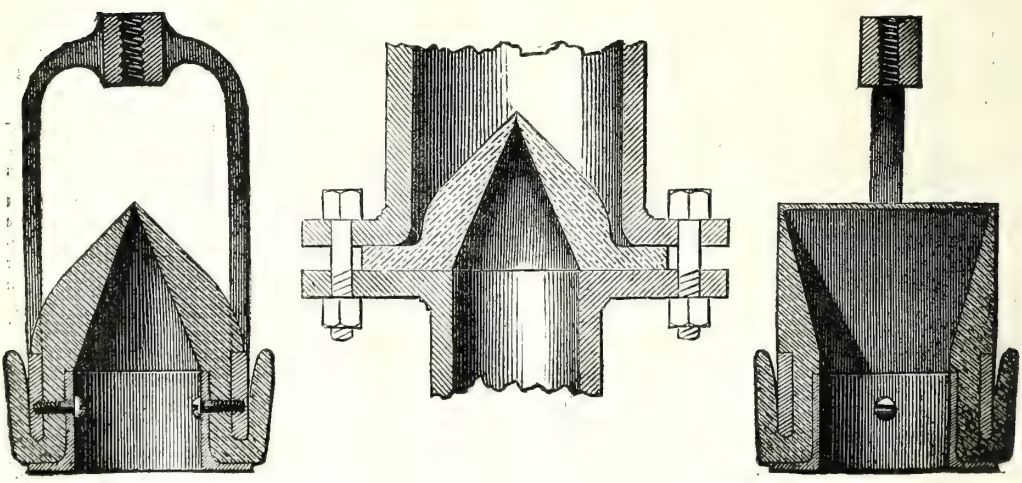
19. Sectional Model of an Iron Tap; W. S. Wheatcroft.

20. Patent Slide Valve; Charles Botten and Son, Crawford-passage, Ray-street, Clerkenwell, E.C.

In the construction of this valve, *loose* faced plates C C are introduced, with an elastic substance *f f*, behind them. Against the gun-metal faces of these plates the slide closes. The slide is wedge-shaped, and the advantages gained by this arrangement are: firstly, the ensuring perfectly true contact between the slide and faces, even if not quite truly fitted; secondly, these faces may be taken out without removing the body of the valve or breaking the joints; thirdly, the top with screw, &c., can be removed, leaving the slide shut. (See Drawing, No. 313.)



21. Patent India Rubber Pump Valve; Perreaux and Co., 39, Mark-lane, E.C.



These valves are constructed entirely of India Rubber, vulcanized for the purpose, and take the form of a tube flattened at one extremity, something similar to the mouth-piece of a hautbois, and approaching as nearly as possible in form and action the valves contained in the human heart. The thickness of the sides of the upper part diminishes gradually to the top, where the two sides meet and form lips, which, when the valve is in a state of rest, are in close contact, and prevent the downward passage of the fluid. With any upward pressure the lips freely separate and allow of the upward passage of the fluid. The gradual tapering of the sides forming the lips of the passage, enables the valve to open and close with the slightest variation of pressure, and, by properly proportioning, to resist any required amount of downward pressure. The passage for the fluid is larger in these valves than in any others of equal dimensions; They also possess the advantage of having a "clear way," there being nothing to retard the passage of water, and owing to the self-acting principle imparted by the elasticity of the material, they close perfectly and instantaneously the moment the pressure from below ceases.

22. Patent Rotary Engine; Carl Heinrich Schroder, Altona, Duchy of Holstein. Exhibited by Davies and Hunt.

The principal novelty in this invention consists in placing the cylinder or steam space (in which the piston and shaft revolve) with its axis at an angle of more or less inclination to the axis of the shaft and piston, instead of their axes being coincident, as is usually the case; the said steam space being divided into two equal parts in a diagonal direction, by means of a circular disc placed at right angles to the axis of the shaft, and provided with an opening through which a solid piston fitting the steam space works. The engine may be arranged so that the cylinder may be stationary, with the disc attached to the shaft, which passes through stuffing boxes placed at an angle with the axis of the cylinder, in which case the piston moves round the shaft with the disc; or the cylinder and disc may both be stationary, in which instance the interior of the cylinder must be spherical and divided into two hemispherical spaces by means of the disc, and two circular blocks are to be placed upon the shaft, one in each space, in such a manner as that their axes shall coincide, and shall cross the axis of the shaft at an angle passing through the centre of the sphere. In this case, although the interior of the cylinder is spherical, yet the steam space revolves as it were upon an axis diagonal to the axis of the shaft. A modification of this arrangement may be made wherein the whole of the engine and cylinder revolve together. In this latter case the interior of the cylinder is spherical, and the two circular blocks with a fixed piston or steam stop between them are placed upon and revolve round the axis of the shaft, whilst the cylinder and disc revolve round an axis which crosses that of the shaft at an angle passing through the centre of the sphere.

23. Improved-Double Action Ships' Pumps; T. Suffield and Co., 13, Bermondsey-wall, S.E. and Perreaux and Co., 39, Mark-lane, E.C.

These pumps are fitted with Perreaux' valves, above described. The valves will pass with ease any foreign substance that may enter the suction pipe, and are not affected by being out of use for a considerable time. The arrangement of these pumps affords facilities for cleansing the suction pipes, and examining the valves, and they are so constructed that a pair of common main or bilge pumps can be connected in a few minutes into a powerful fire pump.

24. Single Action Ships' Pump; T. Suffield and Co., and Perreaux and Co.

This pump is on the same principle as the foregoing.

25. Murray's Patent Improved Pump. Exhibited by Thos. Middleton, Engineer, Loman-street, Southwark, S.E.

In this pump the lifts are joined to the chains at right angles, and allow them to pass over a small-tooth pulley at the top and a bend at the bottom, so as to feather the lifts on the return side. This pump is not liable to be choked, as any foreign substance getting between the lift and the barrel would, by a partial back-turn of the chain, be immediately released, the lift folding up, and letting the substance free.

26. Patent Oscillating Pumps; David Falconer, 68, Causeyside-street, Paisley.

The chief feature in these pumps is the flexible chambers of leather or India-rubber. In each chamber there is a valve opening inwards, and communicating with the pipes which descend into the fluid to be raised. A forked pipe is connected with the top of each flexible chamber, having a valve opening upwards, which allows the pressure to act through the pipes, and the fluid to be raised to its required height. The specimens shown illustrate the application of the principle to house, garden, and agricultural purposes.

27. New Fire-engine. Exhibited by L. de Fontainemoreau, 4, South-street, Finsbury, E.C.

This fire-engine is composed of two cylinders, in which are two pistons attached to a piston rod. The upper piston works in the inner cylinder, and the lower piston, furnished with a valve opening upwards, works in the outer cylinder. Between the two pistons is an air vessel open at the bottom, and attached to the piston-rod. On the ascent of the two pistons the lower one forms a vacuum, which draws the water from the reservoir into the outer cylinder, through a valve placed at its lower part. Half of the water in the cylinder is thus forced out of the delivery pipe, whilst the other half follows the ascent of the upper piston. When the two pistons descend, the valve at the bottom of the outer cylinder closes, and the valve of the lower piston opens. During this time the upper piston, performing its stroke, forces the water back into the delivery pipe. A small tube placed under the valve at the bottom of the cylinder, allows a small quantity of air to enter the air vessel between the two pistons on the ascent of the latter. The air becoming compressed, enables a regular and unintermittent flow

of water to be obtained. A small hole is made in the middle of the outer cylinder, which hole opens into a tube to carry off the waste air and water to the bottom of the cistern. The rod of the pistons is fixed to a horizontal lever, by which the fire-engine is worked.

28. Tubular Air-Heating Apparatus for the Ventilation of Mines; J. M. Paull, Alston, Cumberland.

This apparatus consists of a series of tubes built into the chimney above the furnace, with one end opening into the mine, and the other into an upcast shaft. By this arrangement all the air, pure or impure, may be brought into contact with the rarifying agent, and even explosive gases, without risk of accident. (See *Mining Journal, Railway and Commercial Gazette*, Jan. 30th, 1858.)

29. Dubrulle's Patent Safety Lamp. Exhibited by J. W. Lord, 32, Boar-lane, Leeds.

The improvement consists in the arrangement for preventing the lamp from being opened without being previously extinguished. This is effected in the following manner:—A male vertical screw is engaged in a nut with a female screw, forming part of the wick-holder, which moves up and down in a slide by turning a button. The wick-holder, when lowered, acts upon the forked extremity of a wire that releases a spiral spring, which, when the lamp was closed, forced its upper extremity into a hole in the diaphragm and prevented its turning; this wire once lowered, the top of the lamp can be taken off, but as the wick-holder has been previously lowered, the flame has been extinguished before it is possible to open the lamp. Instead of employing the screw to raise and lower the wick-holder and compress the spring, the wick-holder can be furnished with a hook-shaped wire, which moves a pinion placed upon a horizontal arm extending beyond the reservoir, and carrying a similar button, and the oil reservoir can by this means be made shallower.

30. Machine to Crush and Dress Metalliferous Slags and Stones; Herbert Mackworth, M. Inst. C.E., Government Inspector of Mines, &c., Clifton Wood House, Bristol.

The refuse slags, cinders, &c., of iron and other smelting furnaces contain variable proportions of metal, which are now thrown away in enormous heaps, and are lost. Those portions of the cinder which contain most metal have the highest specific gravity, which property may be employed to separate the richer from the poorer portions. The cinders should be allowed to run from the furnaces into water to granulate or soften them. They are then filled into the crushing and separating machine, represented by this model. A double row of light *stamp heads* break up the cinders. The steep slope between the two rows of stamp heads allows the fragments passing from the first row of heads to turn over, so as to present their edges to the next row of heads, and be more readily and completely crushed into granular rather than splintery fragments. The cinders then descend into the separator, when a current of water is driven upwards in pulsations by the pump. The particles are arranged by this current in the order of their specific gravities. The lighter portion is pushed over in the shale shoot. The heavier portion can be removed from the door in the lower part of the separator, or allowed to fall into a tank. The addition of an endless feeding band and of a dredger, or Jacob's ladder, to bring up the heavier portions out of the tank, will render the machine self-feeding and self-delivering. The water returns to the pump at each stroke by perforations in the side of the separator. The same machine can be employed for separating the small nodules of clay ironstone from the shale, in which they are imbedded. The shale is cracked by the stamps, but the nodules, being much harder, are not so crushed. Fragments of shale still adhere to the ironstone, and are removed by the rolling over and attrition caused by the revolving arms in the separator, aided by the vertical action of the water. The shale being lightest passes off at the top, the ironstone nodules at the bottom. The crushing and separating can be performed at sixpence to ninepence per ton. This machine is also suitable for separating earth or sand from iron ores of the secondary formation, now much employed in the manufacture of iron. Specimens of shale containing ironstone and of iron slags are exhibited as they exist in the hills of cinders which surround the iron works.

31. Machine for Crushing Shale containing Ironstone: Herbert Mackworth.

In the carboniferous measures interstratified with coal are seams from 1 to 15 feet in thickness of shale, containing from 10 to 50 per cent. of hard nodules of ironstone. These nodules contain from 5 to 10 per cent. more iron than the balls and beds of ironstone usually worked, and will make a superior quality of iron, but are now wholly, or almost wholly, unworked, as machinery has not yet been applied to effect the separation of the ironstone. Many of these seams can be quarried at the out-crop. Other iron ores also occur in a pisolitic form, and require separation from the matrix in which they are imbedded. The rollers represented in the model break up or crack the shale in four directions, without injuring the nodules of ironstone. Instead of the ordinary counter-balance weight, the rollers are held together by vulcanized india-rubber cords, or other springs. By a cord of caoutchouc, three inches in diameter, consisting of many small cords, a pressure of four tons can be conveniently given. When a large lump of ironstone enters by accident the elastic cords allow the rollers to separate and pass the lump without fracturing the axis of the roller. The ironstone nodules may be separated at once from the shale by the separator, represented in the preceding model.

32. Coal Purifer; Herbert Mackworth.

This model represents a more perfect form of coal purifier than those applied by the patentee in the coal districts of England and Belgium. Coal, especially small coal, contains a quantity of shale and pyrites, amounting frequently to 10 per cent. The pyrites contains the whole of the sulphur in coal. In order to separate these impurities, which greatly deteriorate its value for all purposes, the coal is brought by an endless band (not shown in the model) in a continuous stream into the coal shoot. As the coal

falls from this shoot in a broad thin shower, a current of air passing to the fan removes the fine light dust, which would, if allowed to enter the water separator, absorb too much water. As shale is specifically heavier than coal, and is not so friable, the fine dust thus separated by air is almost perfectly pure coal. The rest of the coal falls into one side of the separator marked rough coal, where vertical currents or pulsations of water are driven up through it by the piston and its valves, which open downwards. As the coal and shale rise and fall by this current of water, they slide up and down against a perforated division of the separator, and the finer particles pass through the holes into a second division, where the current of water is more gentle and regulated to the finer particles by the current regulator or shutter. The shale settles to the bottom of the separator, and passes through valves into the shale box, out of which it can be removed in a continuous stream by a small dredger (not shown in the model). The pure coal remains at the top of the separator, and is carried forward by the blades or rakes attached to the perforated wire endless band. These blades raise the coal out of the water in order to let the latter drain off, and then discharge it down a shoot into a train placed to receive it. As the purified coal descends the shoot, the fine dry coal dust before mentioned is driven on to it by the fan in a continuous shower, and the per centage of moisture in the whole mass is small. The water flows upwards through the wire guage which acts as a filter to keep back the coal, but it does not get clogged as it is in motion, and a fresh surface is continually presented. The filtered water flows back by a side channel on to the piston, so that there is no waste of water. The endless wire band presses on longitudinal brushes, which prevent the water passing from one compartment to another, except through the wire filter. The machine is nearly automatic, feeds itself, and delivers its purified coal into one train, and its shale and pyrites into another. The attention of the man working it has to be simply directed to prevent too much shale collecting in the separator and passing over with the coal. This he regulates by opening the shale more or less. The machine divides the coal into three parts, and, after separating the particles according to specific gravity, reunites them. There is no water or coal wasted. The cost of separating coal from its impurities, by this machine, is from 2d. to 3d. per ton, including all expenses of engine power, attendance, &c.

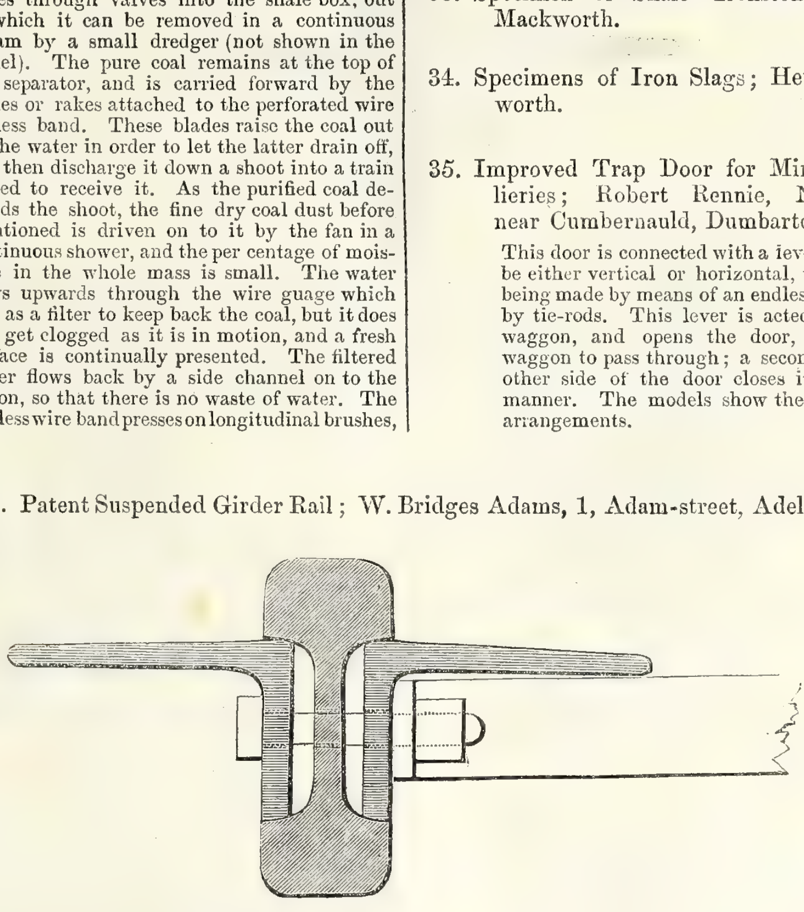
33. Specimen of Shale Ironstone; Herbert Mackworth.

34. Specimens of Iron Slags; Herbert Mackworth.

35. Improved Trap Door for Mines and Collieries; Robert Rennie, Netherwood, near Cumbernauld, Dumbartonshire.

This door is connected with a lever, which may be either vertical or horizontal, the connection being made by means of an endless wire-rope, or by tie-rods. This lever is acted upon by the waggon, and opens the door, allowing the waggon to pass through; a second lever on the other side of the door closes it in a similar manner. The models show the two different arrangements.

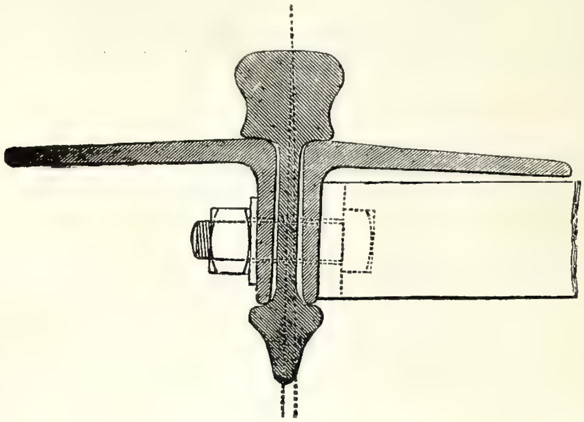
36. Patent Suspended Girder Rail; W. Bridges Adams, 1, Adam-street, Adelphi.



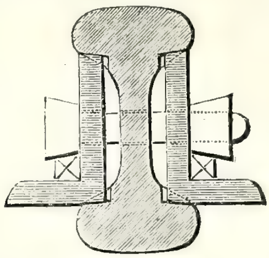
This rail is arranged to remedy the defects in the ordinary arrangement. In the double-headed rail, as applied on the London and North Western Railway—the whole is of wrought iron, in four types or parts—the rail which may be single or double-headed; the angle bracket; the belt; the tie or guage-bar, the length of which determines the guage. The rail is 7 inches in depth; the angle-brackets spread to a width of 13 inches, and each joint, whether of rail or bracket, is intersected by two solids, and the tread of the rail is only 2½ inches above the bearing surface on the ballast, being equivalent, in bearing area, to a cross sleeper-road, with the sleepers spaced 2 feet 6 inches apart. Thus the rail, 7 inches deep, has nearly twice the vertical strength of the common rail, the squares of the depths being as 49 to 25; the horizontal strength, by reason of the angle-brackets, is increased manifold. This rail being double-headed, and not liable to damage by being placed on chairs, it may be turned upside down and end for end. The specimen shown is produced by the Ebbw Vale Company.

37. Single-headed Girder Rail; W. B. Adams.

This specimen is similar to those used on the Bombay and Barroda Railway. The depth of rail is the same as the double-headed rail; the total width is 12 inches. It was produced by the Rhymney Company. These systems of rails require no skilled labour to lay down, either on ballast or on natural ground. They require little maintenance, lying steady, and possessing the same mechanical elements of stability as a well-built ship, broad beam, deep keel, and no top hamper. As the bearing is on the surface of the ballast the moisture in the earth or ballast is forced upwards, instead of lying in pools below; and, calculating by the quantity of ballast used in the cross sleeper-road, one half the amount will serve for the girder-rail. In maintenance the ordinary "beating" is not required; the rail is lifted, when necessary, by a long lever passed below it, in the form of a long wave, without bending at the joints, and the ballast is shovelled under it. The bolts do not get loose, being embedded in the solid ballast, and the rail is, at the same time, sufficiently elastic to prevent rigidity at high speeds by a slight vertical yielding of the angle-brackets.

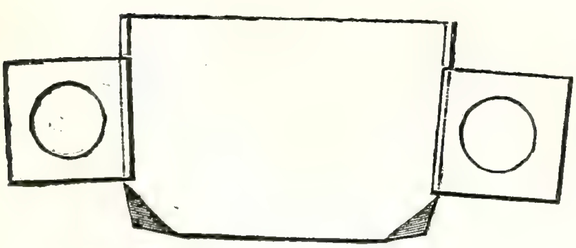


38. Improved Fish Joint; W. B. Adams.

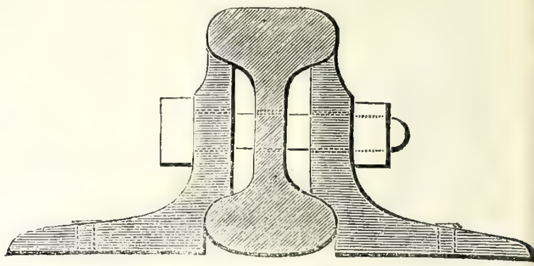


This joint is joined by stamping the rail-ends into square channels, in which ribbed fishes of great lateral strength are recessed. The bolts and nuts are formed to key fast against the ribs.

39. Mode of Securing ordinary Fish or Bracket Bolts, by drawing Plate-wedges between each pair; W. B. Adams.



40. Bracket Joint for ordinary Double-headed Rails; W. B. Adams.



These are used on the Great Northern and South Western lines, and may be either in cast or wrought iron.

41. Railway Bridge of Small Span; W. Bridges Adams.

This shows the double-headed girder rail, formed by two rails bolted together externally, for railway-bridges of 12 to 15 feet span. This completes the whole bridge structure, with rails included, and only requires to be laid upon the abutments of stone or timber on either side of the opening.

42. Patent Wrought-iron Railway Chair; Chas. Robert Moate, 65, Old Broad-street, City, E.C.

This invention consists in holding the rails by a chair rolled in two pieces, of such a form as that each half of the chair may receive the lower flange of the rail on either side, the jaws of the

two portions of the chair being bolted together through the middle portion of the rail.

43. Patent Railway Chair; R. J. Badge, Manchester.

This chair is constructed in two pieces, having the joint under the rail. The rails are fixed to the chairs by screw bolts running through them. (See Drawing, No. 322.)

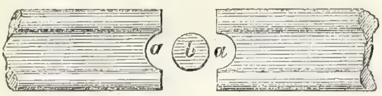
44. Patent Cotter-joint Chair; R. Taylor and R. Worswick, Ipswich, and J. Lovatt, Sudbury.

The principal peculiarity of this joint is that the cotter passing transversely through the chair and slots in the ends of the rails, holds the rails firmly on the bottom or bearing surface of the chair, so that they do not depend on side keys or wedges to prevent their rising. This prevents the rails sliding or creeping through the chair, at the same time allowing sufficient freedom for expansion or contraction on change of temperature. The wood keys press the rails to the side of the chair, thus ensuring an even joint both on the surface and edge. (See *Practical Mechanics' Journal* for January, 1858.)

45. Patent Cotter Joint Clutch, for suspended joints in rails; R. Taylor and R. Worswick, and J. Lovatt.

The principal peculiarity of this joint is that the cotter passing transversely through the clutch and beneath the ends of the rails, prevents vertical play, whilst there is sufficient freedom for expansion or contraction. The bolts through the lip and rails serve to keep the rails fair on the edge.

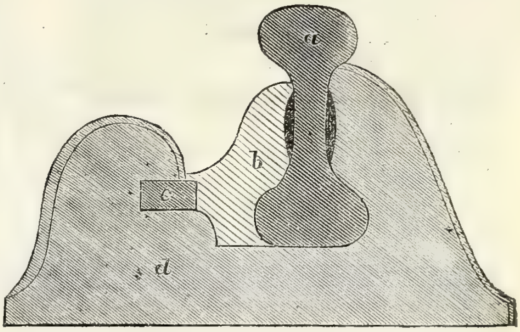
46. Patent Railway Fastening; R. Butterworth, Chelsea, S.W. Exhibited by Davies and Hunt.



In the end of each rail a semi-circular notch is cut in the web of the rail, so that when the ends of the rails are placed together the two notches form a circular hole. In this hole a circular key, *b*, of wrought or cast iron is placed, the said key being the same thickness as the web of the rail. When the joint is supported in a chair the ordinary wooden key keeps the circular key in its place.

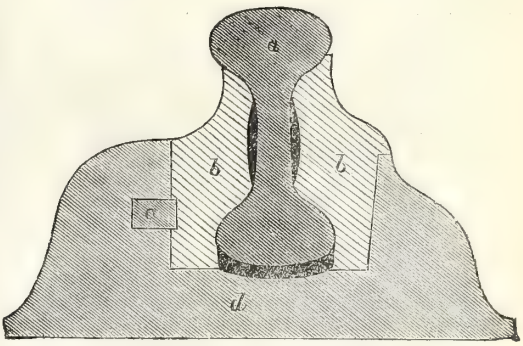
47. Patent Railway Fish Joint Chair; J. Nickless, Coalbrook-dale, Shropshire.

The peculiarity in this joint chair is, that it affords vertical and lateral support to the rails; this is effected in the following manner:—A fish piece of cast iron is wedged between the rails and the ears, by means of a horizontal wedge; the wedge, being made of wrought iron, is partly split, so that by opening or clinching it, it will remain immoveable.



48. Patent Railway Chair; J. Nickless.

This chair has two cast iron fish pieces which are lifted out with the rail, being wedged with a horizontal wedge. The rails, instead of resting on the bed of the chair, rest on the top of the fish pieces, thus saving the lower portion of the rail from wearing. This chair is cast without a chill.



49. Patent Key Dog Fish for Railway Joints; Honourable W. E. Cochrane, 5, Osnaburgh-terrace, Regent's-park, N.W.

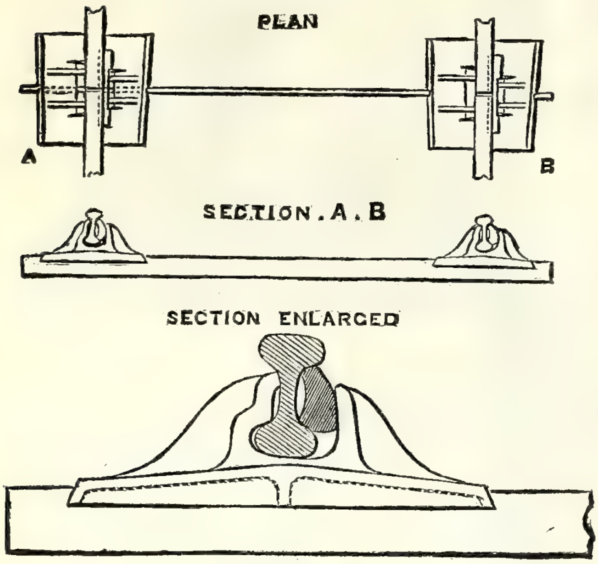
This fish has two or more projections upon it, which fit into corresponding holes in the rails. The fish is secured in the chair by means of a key. This chair has been used on the North Western Railway.

50. Patent Continuous Bed-plate Iron Solid Sleeper Roadway; Thos. Wright & Co., 9, George-yard, Lombard-street, E.C.

The distinguishing feature of this invention is the employment of a single sleeper, as a complete piece of roadway in itself, consisting of one compact and solid mass of iron, capable of sustaining a pair of rails without any longitudinal or transverse joints, being similarly constructed to the bed of a lathe, planing-machine, or steam-engine solid iron bedplate. A slip of wood is interposed between the rail and sleeper, as also between the ends of the sleepers, to lessen the rigidity of the structure. (See Drawing, No. 328.)

51. Patent Bed-plate Transverse Iron Solid

Sleeper, with the Vice-jaw Rail Fastening; Thos. Wright and Co.



In this arrangement each sleeper is independent and complete in itself, and when multiplied continuously, forms the iron way of the railroad, and being on the transverse system, is as readily applied to the rails of existing railways as the common cross sleeper, simply substituting the improved iron for the decayed wooden sleeper; and (as by the action of a vice) the rails are connected to and disconnected from them, at pleasure. The wooden or iron keys, chairs, spikes, &c., are superseded.

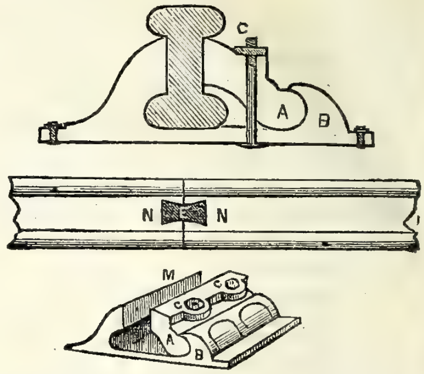
52. Wedge-Joint Chair; Benjamin Burleigh, 26, Great George-street, S.W.

This is a long and heavy chair, with a long cast-iron wedge or an elastic wrought-iron key, fitted on one side in the channel of the rails, and on the other bearing against the jaw of the chair, low down, so as to put very little breaking strain upon it. The angle is very acute, and the keys are placed in the chairs in such a direction that the action of the trains tends to tighten them. This chair has been in use on the Great Northern Railway for two years.

53. Permanent Way; Benjamin Burleigh.

The cast wedge chair above described is formed into a cast sleeper by extending the base, which presents a wedge form on the plan. Opposite chair sleepers are connected by a wrought-iron tie bar, which wedges upon the sleepers, and serves as a tie to strengthen each sleeper while keeping it in position. Thus the whole system of fastening is so arranged by wedges, that the motion of the trains tends to tighten them. The rails are of the usual double-headed section. As a variation these chair sleepers are sometimes used with an elastic wrought-iron key, made to expand in the driving against a wedge-shaped lip on the jaw of the chair. This Permanent Way has been in use for two years.

54. Improved Fish Joint; W. H. Myers, 202, Whitechapel-road, E.



C Bolt and Nut. A Knuckle piece. B Raised piece.
M Opening for rail. NN End of rails. E Dove-tail piece.

This chair is made suitable to fit the rail in the ordinary manner on the inside; on the outside is cast a raised piece, which is grooved or hollowed out circular across the entire length of the chair, to receive a circular knuckle piece, which acts or works in the groove or hollow formed in the chair; into the chair are inserted one or more bolts with their heads recessed into the bottom of the chair, which, passing through the bottom of the chair and circular knuckle piece, are fastened with nuts on the top, as shown in the woodcut. The joint of the rail is fished by means of a female dovetail, slightly bevilled, cut in the end of each rail, into which is placed a male dove-tail piece, also slightly bevilled to fit the female dove-tail in the ends, which, by aid of the chair before described are held firmly together at their junction.

55. Fish Plate for Permanent Way of Railways; James Murphy, C.E., Newport, Monmouthshire. Exhibited by John Gedge, 4, Wellington-street South, W.C.

This differs from ordinary fish plates, by having a supporting plate under the joint of the rails, with side plates made to the form of rail and securely bolted through the rail.

56. Patent Railway Treenail Extractor, and Improved Patent Treenails; R. J. Badge, Manchester. Exhibited by Ransomes & Sims, Ipswich.

To withdraw an ordinary treenail, a coarse-threaded screw, having an eye at its upper end, is inserted into the head of the treenail. This eye is attached by a short pin to the lower end of the extractor, when by turning the lever at its upper end the treenail is safely withdrawn. In the case of withdrawing Badge's Improved Treenail it will be only necessary to attach the eye of the iron parallel key to the Extractor, and this key being withdrawn, the wooden portions of the treenail may be removed easily by hand. The improvement in the treenails consists in having a slot cut in the direction of their length, into which an iron key of parallel thickness is firmly driven, after the wooden treenail shall have been driven into its place.

57. Patent Ascending Apparatus; De Cristoforis, 63, Regent-street, W.

On the side of both the propelling wheels of an ordinary locomotive, near the circumference, a given number of small wheels are fixed. These wheels form a series of continual supports against a series of projections connected with the rails. This arrangement enables the locomotive to ascend very steep inclines with perfect steadiness and without fear of ripping, as in the case of ordinary cog-wheels and racks.

58. Whitworth's Self-acting Signal Apparatus and Announcing Bell. Exhibited by B. Vickers, Atlas Works, Sheffield.

In this apparatus the wheels of the engine act upon a lever arm, and depress it. This releases a catch in connection with a sliding bar attached to a balance weight. The weight then falling causes the "danger" signal to be shown, and, at the same time, a bell to be rung. If the danger signal is required for shunting a train, the pointsman has only to turn the windlass somewhat further than is requisite for setting the apparatus for the ordinary signal, and this causes an erection on the sliding bar to press on a double lever, which, lifting up a vertical catch, releases the slide, and thus permits the weight to act on the signal.

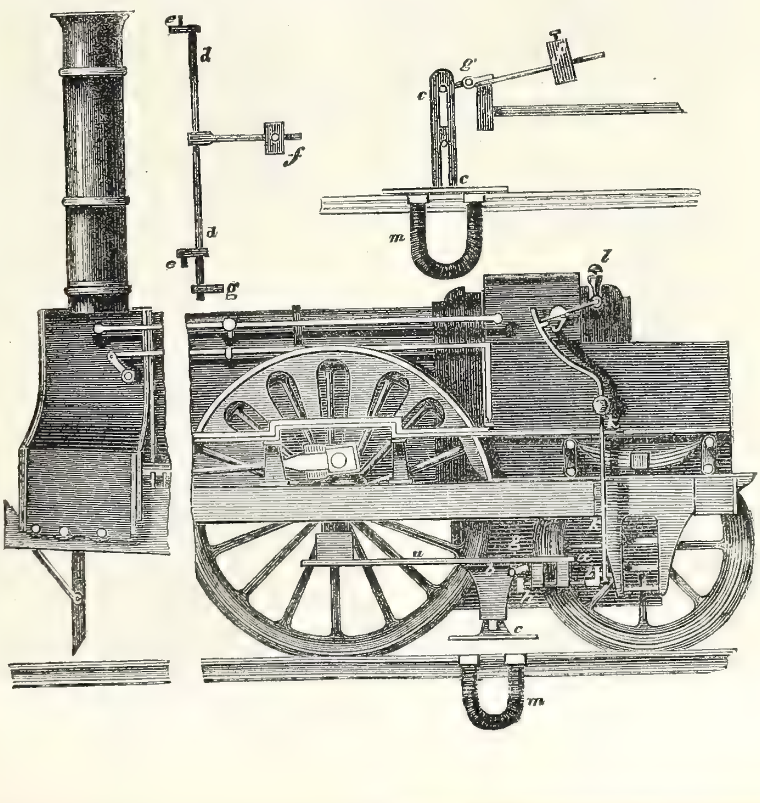
59. Patent Switch Point and Signal Controller, for Railway Junctions; John Harrisson, 3, High-street, Homerton, N.E.

This invention consists in connecting the signals with the switch levers, so that the act of setting the switch throws the signals into such a position as to prevent any train advancing but that for which the switch is set. The signals, when left to themselves, are kept elevated at danger, by means of weights on the horizontal arms of bell-crank levers, and, when the switch lever is placed in one or other direction for setting the points, the rod is drawn through the eye of the one bell crank lever, while a stop is brought into contact with the other, raising the weight and allowing the signal to descend. This rod, being attached to the switch lever by a clutch, can be instantaneously disconnected.

60. Gibson's Patent Self-acting Railway Signal and Telegraph; Young and Pool, Hull.

In this system of signalling, the wheel of the engine, in passing over and depressing a gently inclined lever fixed to the rail, causes the signal-post connected with it to turn to a position at right angles to the line, and thus to indicate "danger" to the driver of the following train. The post remains in this position until the first train has safely progressed a certain distance (say 1,000 or 1,500 yards), when, by the depression of a similar lever, opposite another post, the first signal is altered to "all right," and the second at the same moment indicates "danger," to be in turn released by the third, and so on. The depression of the lever previously mentioned will, when so arranged, cause an electric bell to ring at any station or stations either in advance or in the rear of the moving train, which will thus announce its own approach to, or departure from, any station, tunnel, curve, or other dangerous part of the line. The bell continues ringing until the lever next reached releases it. Another arrangement includes a self-acting compensation for the expansion and contraction of stretched wire. This is effected by an arrangement of balance weights, which keep the wire at one uniform tension in any temperature, without attention. It is applicable as well to the hand signals now in use as to the self-acting signal first described.

61. Patent Railway Signals; W. Bond Paul, Langport, Somerset.

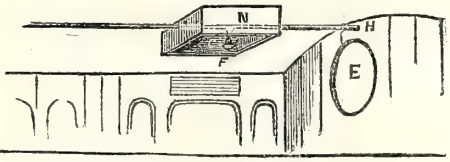


This invention consists in placing along a line of railway, and at such distances from each other as may be found desirable, electro-magnets fixed near to the rails, which, when in action, on the passing of a train, attract a lever attached to the engine, and so placed as to be brought near to the poles of the magnets. This lever, being drawn towards the magnets, on coming within their influence, opens a communication between the steam reservoir of the engine and a whistle. At the stations which the trains run from, a galvanic battery is placed, and from this battery proceed two wires to the next station—one from the positive, and the other from the negative pole. One of these wires passes around or communicates with all the electro-magnets in succession, and, consequently, if the circuit be completed—which may be readily done at any part of the line by placing an electric conductor in contact with two wires —those electro-magnets which are between the points of contact and the battery are at once rendered operative.

62. Signals for Trains in Motion; W. H. Myers, 202, Whitechapel-road, E.

These signals can be applied separately or in conjunction with each other, and may be thus described. The passengers' lamp and sema-

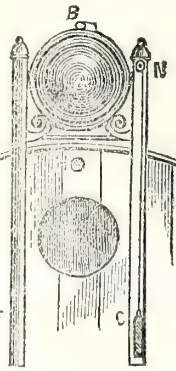
Fig. 1.



H Enclosed Bolt. F Bolt Handle. N Metal Case. C Glass at bottom of Case. E Circular Window.

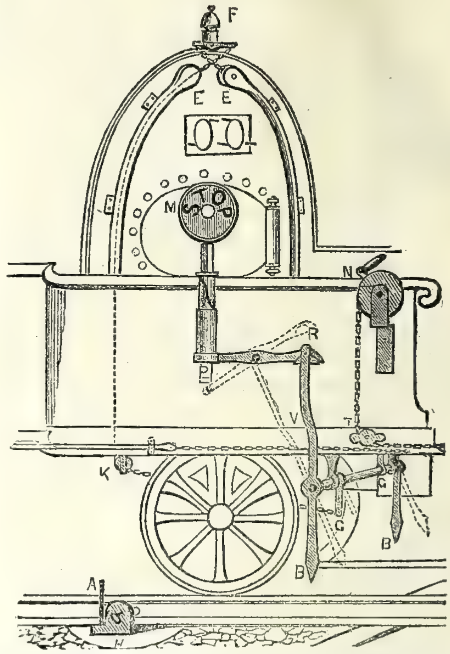
phore signal, as shown in Fig. 2, is put in action by an enclosed bolt fixed to the roof the whole length of carriage; in every compartment a handle is fixed to the bolt; each of these handles is enclosed in a metal case with glass bottom, as in Fig. 1; to get at the handle the glass must be broken. When the passenger withdraws the bolt, by means of counterbalance weights, the lamp or semaphore rises above the roof of the carriage, as shown in Fig. 2, which could be seen by the guard. One signal is sufficient for a carriage. At night, the lamp being down opposite the circular window will give light inside the carriage, serving two purposes at one expense. Fig 3.—Under the foot-

Fig. 2.



A Lamp or Semaphore. B Catch for Bolt. C Counterbalance weights. E Window. F Tube holding weights. N Friction Pulley in Tube. H Bolt Hole.

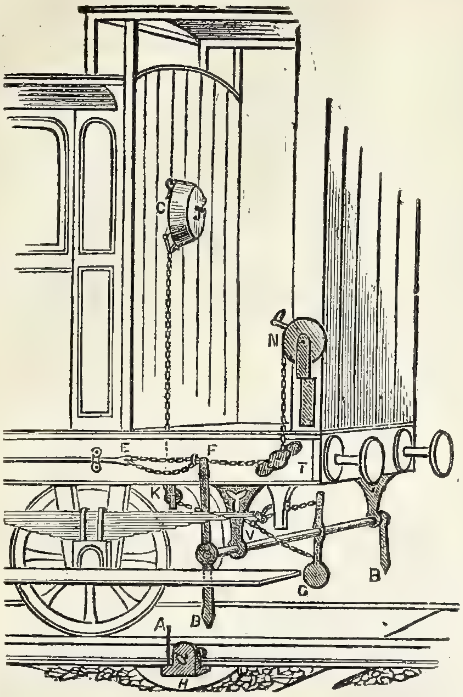
Fig. 3.



F Steam Whistle. EE Tubes with friction pulleys and chains. K Leading Pulley. GG Levers. BB Pendant Levers. V Upright Lever. M Semaphore or Lamp. R Double-armed Lever. N Wheel. T Chain and Pulley. A Screw Clip and Tappet. H Opening for drainage.

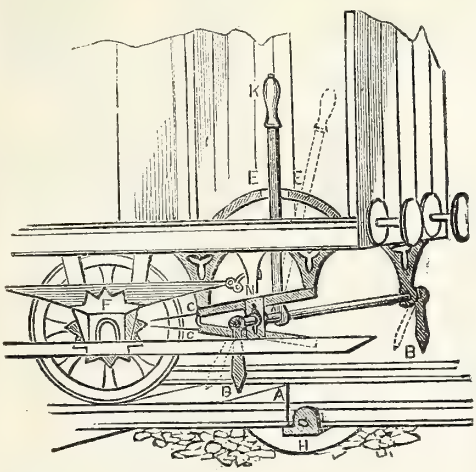
plate of the engine a small shaft is fitted, on which the pendant and other levers are fixed for the purpose of turning on the engine whistle by either guards, station-masters, or any other of the railway officials, acting as a fog or danger signal; it is acted upon, whichever way the engine may be running, by a spring or tappet in a clip screwed to the rail, hereafter described. At the side of the framework of the engine is placed a lamp for night and a semaphore for day, which is attached to a screw supported by a double-armed lever, held in a horizontal position by an upright lever; the pendant lever being struck by the spring or tappet of the clip causes the lamp or semaphore to turn round and present the word "STOP" immediately in sight of the engine-driver. By means of the wheel the engine-driver can give notice of danger to the guard by putting in motion an alarum-bell, as shown in Fig. 4, which is placed in the guard's compartment of the carriage, and acted upon by means of pendent levers fixed on a shaft under the carriage; the pendent levers being also acted upon by the before-mentioned clip; and by the engine-driver's wheel, or station-master's sliding-spring, Fig. 7. The usual lamps placed at the back of the guard's compartment of the carriage, as the last carriage of the train, are made to rise above the roof as a means of signalling between guard and engine-driver, showing to him a green and red light; it has the usual red lights behind at one expense for lighting. Fig. 5.—On an axle of the carriage wheel is fixed a ratchet or toothed wheel, revolving as the car-

Fig. 4.



C Alarum Bell. K Leading Pulley. V Chain Junction. Counterbalance Lever. BB Pendant Levers. F Upright Lever. N Wheel. T Leading Pulley. E Connecting Rod.

Fig. 5.



F Ratchet or Toothed Wheel. CC Springs. K Handle with Lever. BB Pendant Levers. EE Quadrant with Catch. N Small Double-armed lever.

riage proceeds, which is acted upon by means of two springs, over which the guard has perfect control by means of the lever with handle in his compartment of carriage; this ratchet can also be used by the engine-driver by his wheel, and by any other railway official by the screw-clip, on both sides of the carriage. It is calculated that this toothed-wheel would make a rattling noise of greater power than the steam-whistle; it would be quite sufficient to attract the engine-driver's attention, and could be mistaken for no other sound. The communication between guard and engine-driver is effected by rods and chains working through friction pulleys or screw eyes fixed to the carriages.

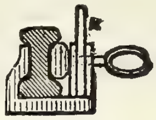
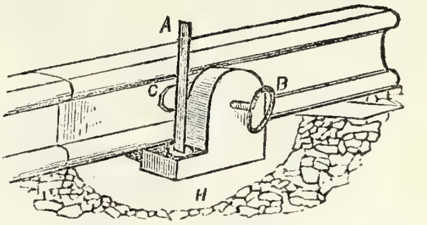
Cross  *Section.*

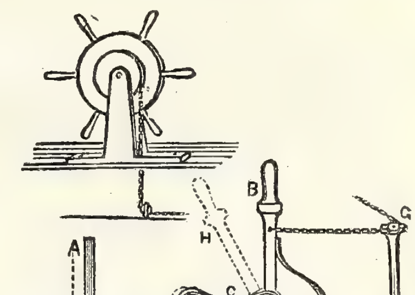
Fig. 6. *Perspective View.*



A Spring or Tappet. B Screw. C Wedge. H Opening for Drainage.

Fig. 6.—The fog or accident screw-clip with spring or tappet is intended to grip the lower flange of the rails by means of a screw, at any of the openings already made for the purpose of drainage between the sleepers. Upon the pendent levers on the engine and carriage striking against the spring or tappet, they will put the steam-whistle, the lamp or semaphore on the engine, the alarum-bell or rattle fitted to guard's carriage, into immediate action, making these signals a complete communication of danger between engine-drivers, guards, station-masters, or other railway officials. Fig. 7—The station-master can give notice of danger to the engine-driver and guard to stop a train in motion, by applying a sliding spring or tappet at a long distance from the station, without the necessity of leaving his duties at the station, causing the steam whistle, the revolving lamp, or semaphore on the engine, and the alarum bell or rattle on the guard's carriage to be put in motion.

Fig. 7.



A Spring or Tappet. B Handle of sliding spring. C Connecting Rod. F Spring at back. G Leading Pulley.

63. Patent Railway Brake; J. Sutherland, 37, Pickerington-street, Paddington, W. Exhibited by J. S. Morris, 3, Earl-street, City, E.C.

The object of the inventor is to lock all the wheels of the carriage or waggon simultaneously at pleasure. This is effected by

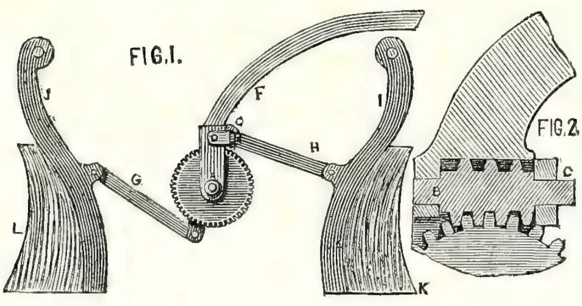
placing drums on all the axle shafts of the carriage; round these drums are placed iron friction-bands coupled to a horizontal lever running along the frame of the carriage. This lever brings the bands into contact with the drums, thus acting as a brake. (See Drawing, No. 327.) —(See *Civil Engineer and Architects' Journal* for July, 1857.)

64. Patent Self-acting Railway Carriage Brake; Wm. Paxon, 23, Skinner-street, Snow-hill, E.C.

This brake is put in motion by the ordinary pressure on the buffer-rods, in stopping a train, and it allows a carriage, immediately on being stopped, to be pushed backwards without the necessity of awaiting the recoil of the buffer-springs. This is effected by means of a drum or wheel running loose upon the axle of the carriage-wheels, and carrying a spring catch, by which it engages, and is borne round with the carriage-wheels whilst proceeding in a forward direction, but from which they are released when turning in a backward direction.

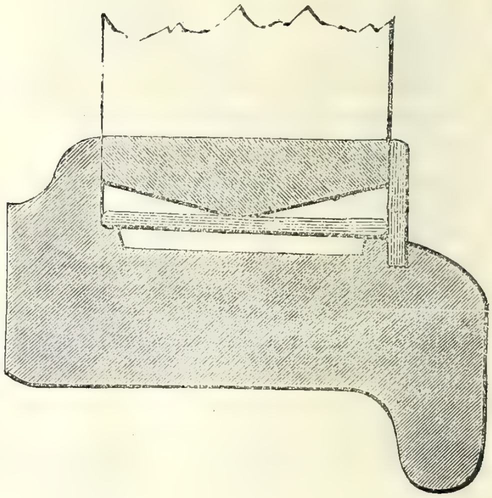
65. Improved Railway Brake: Edward Finch, Bridge Works, Chepstow.

This invention consists in a means of altering the position of the lever in respect to the axis by which the breaks are actuated, so as to compensate for the wear of the blocks, and by this means always to maintain the lever in the same position in relation to the carriage or waggon. For this purpose the end of the break lever is arranged so as to move on the axis by which the breaks are actuated, and the break lever has attached to it a worm which takes into a worm wheel on the axis, so that as the blocks are worn away, by turning the worm attached to the break lever its position can be adjusted so as always to retain the same position in relation to the carriage or waggon.



66. Improved Railway Wheel, entitled a Horse Foot Wheel; W. Bridges Adams.

This improvement has for its object; first, by placing an elastic substance between the tyre and the wheel, to reduce the non-elastic load to the tyre itself, which may be made much lighter, by reason of being saved from blows and by the absence of holes through it; secondly, by this arrangement a lighter wheel may be used, or one of cast iron, inasmuch as, the blow being prevented, there will be no tendency to break; thirdly, the wheel may be put together with the tyre cold by simple screw pressure, without needing skilled mechanics; fourthly, the tyres and wheels being all formed to exact gauges, a worn tyre can be taken off and replaced in any locality without needing workshops or machinery. The tyre is formed with an internal rib at the front, and the periphery of the wheel is turned so as to bear only at its mid-breadth. The internal portion of the tyre under and round the wheel is hollow, and a hoop of spring steel, three inches wide and 3-16 of an inch thick, is supported in two fillets on which the wheel rests. The spring for convenient manufacture is made in two halves, and they form a slight incline, so that the wheel enters easily at the back,



and, being forced up the incline by screw pressure, acquires sufficient tightness to become firm. A small groove, about 3-16 of an inch in depth, is turned in the back of the tyre parallel with the plane of the wheel, and in this is placed a false rib of iron or steel with a small piece cut out of it to allow the rib to be compressed and spring into the grove when the opening is keyed up and the wheel is secured in its place. The wheel is quiet and easy, without any ringing noise. If desired, the tyre may be put on with slight pressure, and the interstice filled with tallow, so that on curves the tyre may move round slightly to compensate for the inequality of the path-way, acting as a loose wheel. The cost of this wheel will not be greater than that of ordinary wheels, as the lightening of the tyre will compensate for the steel. The number of joints is diminished, the ordinary wheel having eighteen joints, and this wheel only six joints. Experimental wheels of this construction have been in use now eight months on the Eastern Counties Railway, first in a coke waggon, and then in a first-class carriage, and they are now being applied on the North London Railway. On the Eastern Counties they are also about to be applied to the coupled driving wheels of a locomotive engine, when they will serve the object of preventing the destruction of tyres and rails and also of equalising the alternate thrust and pull of the connecting rods.

67. Railway Wheel; W. Bridges Adams.

This model shows wood applied in a continuous hoop between the wheel and tyre.

68. Improved Railway Wheel; James Murphy.

69. Patent Locomotive Engine; George Inman, Susannah-street, Poplar, E.

The object of this invention is to economise motive power when applied to locomotion. This it is proposed to effect by causing high-pressure steam or other motive power to expand a series of hollow discs or steam chambers arranged round the axle, and carried by each of the wheels of the locomotive. These discs or chambers are connected by radial pipes to the boss of their respective wheels, and have attached to their outer or moveable ends radial rods, which pass through slots in the periphery of the wheels, and carry feet, which bear upon the ground in succession, for the purpose of driving the engine forward. The steam is generated in a boiler mounted on the frame of the engine, and it is conducted through the hollow axle of the driving wheels to the boss of the wheels, whence it passes through the radial steam pipes to the several hollow discs or steam chambers. Between the boss of each driving wheel and the axle is an annular valve, which admits and discharges the steam at the proper time to and from the several steam chambers in succession, and by an arrangement of shifting gear, the position of this valve may be changed at pleasure, so as to reverse the motion. The steam chambers of the discs may be usually made of india-rubber, joined together at their outer edges by a ring of metal, which will prevent them from expanding in the direction of their diameter; but when great power is required to be exerted, the expanding and contracting chambers may be made of metal.

70. Apparatus for expediting Town Postal Communication; O. H. Hodges, 5, Crown-street, Finsbury-square, E.C.

It is proposed that this apparatus should consist of a subterranean tube, with small boxes or carriages travelling within it, for receiving letters dropped into pillar letter-boxes. The letters are thus to be constantly transmitted to the central stations for delivery. (*See Builder*, July 4, 1857.)

71. Patent Omnibus and Carriage Break; Robert Ker Aitchison, New North-street, W.C. Exhibited by Davies and Hunt.

This break is self-acting. When the horses stop the backward thrust of the pole acts upon two levers, which apply the breaks. The same effect is produced by the carriage overrunning the horses in descending a hill. When the horses begin to draw, a spring releases the breaks. There is a treadle by which the driver can lock the pole, and thus prevent the break from acting when backing, or when otherwise desirable.

72. Cab Omnibus; V. De Tivoli, 18, Stanley-place, Pimlico, S.W.

This omnibus is placed on DeCristoforis's conical wheels, and has an arrangement by which a brake is applied on the backing of the horses.

73. Patent Indicator for Omnibuses, &c., Francis Parker, Elm-house, Homerton, N.E.

This apparatus consists of a tube with a box at the top filled with balls. There is an arrangement by which one ball at a time is allowed to fall into a lower compartment, and strike a bell, thus indicating the number of passengers. (See Drawing, No. 363.)

74. Carriage-door Shields; Charles Norton, 34, Hawley-road, Camden Town, N.W.

These are designed to prevent accidents arising from the shutting of railway or other carriage doors. They consist of metal plates, folding over each other, on the hinge side, so as to prevent the possibility of the fingers being crushed.

75. Patent Tubular Carriage Shafts; John Clarke, High-street, Shiffnal.

These shafts are made of a taper tube of malleable iron, and are said to be stronger, cheaper, and more durable than ordinary wooden shafts.

76. Patent Horizontal Fin-expanding Canopy, for Carriages, Boats, &c.; T. L. Scowen, Allen-road, Stoke Newington, N.

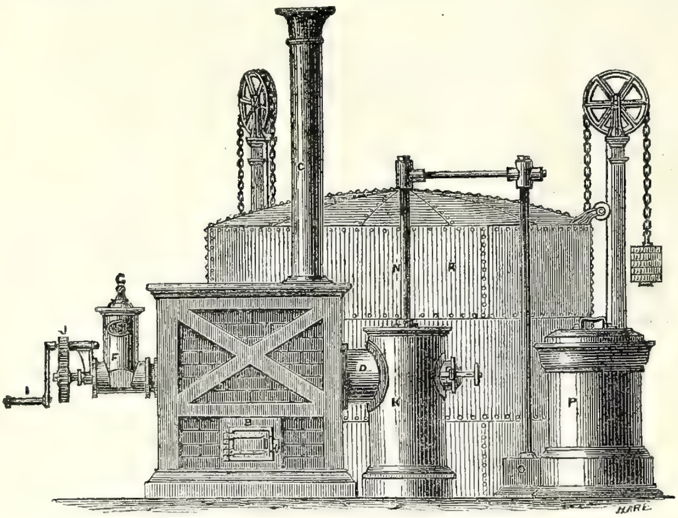
This canopy is constructed on the principle of the fin of a fish, with a horizontal action, which enables it to be made to any shape or size, and to fold up in an instant. A canopy for an open carriage when folded, lies in the compass of an umbrella. It can be made of any material, according to the purpose for which it is designed. The omnibus canopy, which forms a back to the seat when folded, is worked up or down by means of a right and left hand screw, working two nuts, which are attached to the lower ends of standards, enabling the conductor to raise and expand the canopy over the roof in a few seconds. This method of raising or lowering the canopy is equally applicable to boats and many other purposes. (See Drawing, No. 364.)

MACHINERY AND MANUFACTURING APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

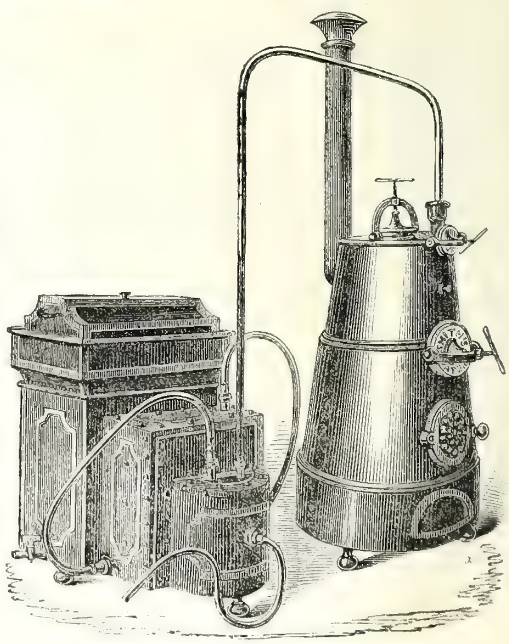
80. National Coal Gas Apparatus; J. T. B. Porter, Lincoln.

This apparatus is suitable for the manufacture of gas either on a large or small scale; but it is peculiarly adapted for supplying private houses, workshops, railway stations, lighthouses, and ships, and consists of a retort placed inside a case lined with fire brick, such retort being furnished with an Archimedean screw for the facility of supplying it with fresh material, the screw at the same time discharging the coke or other carbonised substances which have been exhausted of their gas. Each charge of the retort is led at one end through a vertical pipe, having a flange fixed on its upper end, into which a plug is fitted; this pipe opens into a chamber, in which the screw works, and as fast as the material is exhausted of its gas it is pushed out by the screw at the opposite end and replaced by fresh material, which is traversed through the retort by occasionally turning the screw; this may be done by a winch handle, fly wheel, or gear work fitted for that purpose. The coke or other substances from which the gas has been exhausted fall through a descending discharge pipe into an iron vessel, or a reservoir of water, if required, and may be removed in any convenient manner. The gas passes up through a pipe to the condensing and purifying apparatus. (See Drawing, No. 346.)



81. Patent Gas Apparatus; Sharman and Smith, Wellingborough, Northamptonshire.

This invention consists in using an upright conical retort, with suitable flues, by which means a greater quantity of gas, in proportion to the amount of coal consumed, is produced; and by the manner in which the retort is surrounded with flues, a larger amount of its surface is presented to the action of the fire. In the arrangement for purifying the gas, the supply of water through which the gas passes is regulated by means of stop-cocks; the purifyer and the gas are made to take a long and tortuous course through the water, and over and under a sufficient number of beds of lime before passing to the gasometer. The model shows a complete apparatus for making gas to supply three or four lights, with the exception of the tank and holder.

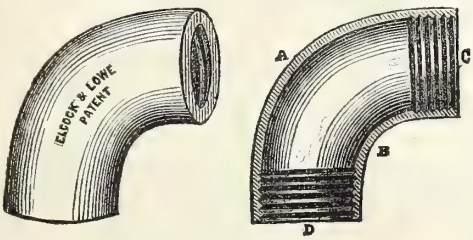


82. Patent Dry Gas Meters; James Meacock, 7, Snow-hill, and Giltspur-street, E.C.

In this meter the leather diaphragm is held between two flat metal rings and screwed up to a frame, instead of being fastened with the soldering iron, which is apt to injure the leather. The valve adopted in this meter does not rise from its facing.

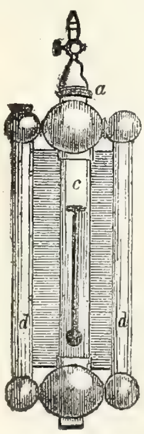
83. Patent Wrought-Iron Round Elbow; Elcock and Lowe, Holyhead-road Tube Works, Wednesbury, Staffordshire.

These wrought-iron round elbows may be made from 1-16 to $2\frac{1}{2}$ inches internal diameter, and, being rounded on both the inner and outer sides, ensure a steady transmission of the gas, steam, water, &c., passing through them, and, as the peg or tool upon which the welding is performed is so formed as to circle round the angle B, the inner section is finished and made smooth, and a perfect soundness of weld is ensured.



84. Patent Gas and Air Test Guage; W. Reichenbach, 33 and 34, Borough-road, Southwark, S.E.

This is an instrument for detecting any impurity that may arise in the process of manufacture of gas; also for testing the quality of deleterious air in mines or confined spaces. In the accompanying woodcut, *a* is a cross cap, to be unscrewed for the insertion of test papers into the glass tube *c*, for the detection of any



deleterious product; the tube *c* has also a thermometer (marked *b*) to show the temperature of gas in the process of manufacture; *d d* are side tubes, to give the pressure for distribution.

85. Annular Recoil Engine; T. Ivory, Ainslie-place, Edinburgh.

This engine has two arms, which are open at their outer extremity except in so far as they are closed by an outer ring, and they are arranged so as to be capable of being made to revolve freely within the ring round the centre, at which steam or water is supplied for moving them. There is an orifice at the extremity, for the escape of the steam or water. The area of this orifice may be one-fourth of that of the arm or tube on the cross section. There is a fixed ring supported on a frame work, and the extremities of the arms are all but in contact with the interior of the ring, so that the only outlet of the steam or water from the arms into the atmosphere is through the side orifice at the end of each. On steam or water being admitted into the arms at the centre, and allowed to escape at the orifices, the pressure will cause the arms to revolve by means of the pressure on the area of the orifices, and in the direction opposite to that portion of the outer ring against which the steam for the time impinges. By this means a continuous rotary motion of the arms is kept up while steam or water is supplied. A distinguishing feature of this mode of producing rotary motion is, that whatever be the length of the arms, the effective pressure is always applied on the same area, and thus, by the steelyard principle, the greater the diameter of the circle described by the arms, the less is the expenditure of steam for the same work done.

86. Double Acting Horse Wheel; Thomas Mann, Boro'bridge.

This invention consists of an upright shaft, fitted with a platform at its lower end, upon which the horse or horses walk. This platform is supported by suitable suspension rods connected with a boss on the shaft. The horse or horses are yoked to a bar, which is fixed to a collar or socket revolving loosely round the upper portion of the shaft, so that, as the horses attempt to walk, the motion of their feet will cause the platform to rotate in one direction, whilst their shoulders will push the bar or power lever round in a contrary direction. In order to combine these two opposite movements, a spur wheel is keyed on to the upper end of the shaft, and a set of internal toothed segments are fixed to a set of arms radiating from the loose collar or boss, and revolving with the power lever. Between this internal and external gear is a pinion which gears into both wheels simultaneously, and as they both revolve in opposite directions, they will impart one uniform motion to the pinion, which, through its shaft, transmits the movement to any required machinery.

87. Dynamometer; John Alcock, 3, High-street, Bolton.

This instrument is intended to measure and indicate the power required to drive any particular machine. It consists of a spring balance attached to a band fastened to the periphery of a wheel, attached to one side of which is a frame carrying toothed wheels at one extremity and a balance weight at the other; this is so arranged as to act upon the spring balance, and indicate the strain put upon it.

88. Eighteen-inch Planing Machine; Batho and Bauer, Salford, Manchester.

The novelty of this machine consists in the manner in which the object operated upon may be adjusted, and the arrangement of the link motion, to effect a quick return, as well as uniform motion, whilst cutting. To the underside of the table is attached a screw, the nut on which is connected with the link, so that in planing an object of a hollow square form, it is not necessary to travel over the centre opening.

89. Patent Double-Action Traversing Drilling Machine; Andrew Shanks, 12 John-street, Adelphi, W.C.

This machine is especially adapted for making cotter-holes, mortices, or key-ways in metal; also for grooving shafts, axles, &c. The article operated upon is placed in the centre of the machine by means of the concentric vice and poppet headstud, the two drills being driven by top driving, like an ordinary lathe, the diameter of the drill determining the width, and the variable crank at the end of the machine operating on the carriage determining the length of the mortice or groove required.

90. Patent Horse-shoe Machine; Henry Burden, Troy, New York. Exhibited by Davies and Hunt.

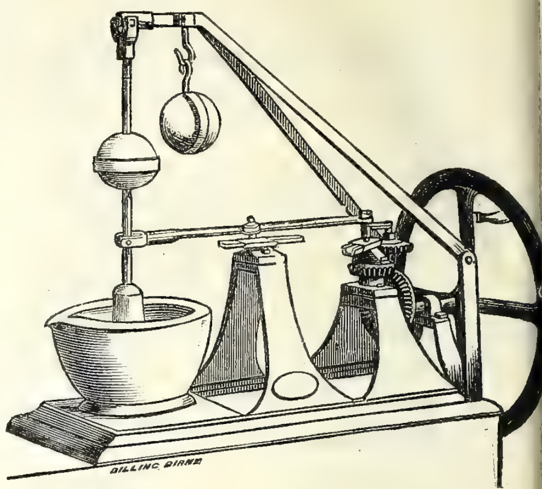
In this machine, the red hot bar is placed in the trough, and is drawn in by the feeding rollers, cut to the proper length, and bent to the required form. The toe is then pressed between two cams, to make it thinner and broader, and bevil the inside; a flange preventing the shoe from spreading. Another cam then punches the grooves and nail-holes, after which the shoe is straightened, and falls out of the machine complete. The machine is capable of making sixty shoes per minute. There is an arrangement for stopping the machine when there is not a sufficient length of bar to form the complete shoe.

91. Double Platform Weighing Machine; Julius Schonemann. Exhibited by R. and L. R. Bodmer, 2 Thavies-inn, Holborn, E.C.

This is suited for small parcels, but the principle is applicable to weighing machines in general.

92. Patent Grinding and Levigating Apparatus; H. Goodall, Derby.

This invention consists in an arrangement whereby the operations of grinding or levigating various substances may be performed by the aid of a pestle instead of rollers or flat grinding surfaces. The materials to be operated upon are placed in the mortar, in which the pestle is made to work by mechanical means, in such a manner as to give the same rubbing motion as is given by hand. The pestle may be weighted to any desired extent, and as it traverses over a different surface every time, there is no necessity for scrapers.



93. Specimens of Irregular-shaped Timbers. Exhibited by Kinder, McNaught, and Smith, Worcester.

These timbers are produced by the wood shaping machine recently patented by Mr. Arthur Kinder. This machine can be made to perform the following operations; sawing, boring, morticing, sur facing, either on the flat or curved work, producing regular, irregular, or winding bevils, tenons, grooves, rebates, &c. It will also saw ships' timbers to the proper shape at one operation. The specimens exhibited are as follows:—No. 1 illustrates planing; No. 2 regular bevil; No. 3 winding bevil straight; No. 4 six specimens of tenon cutting; No. 5 curved work on the square; No. 6 curved work on the winding bevil; No. 7 curved work on the regular bevil; No. 8 curved work on the horizontal; No. 9 rebating, square and bevilled; No. 10 grooving with quirk on edge; No. 11 curved grooving; No. 12 boxing irregular surfaces; No. 13 beading; No. 14 double compassed work. Eleven pieces marked A are full-sized carriage timbers, joined wholly by machinery. (See *Practical Mechanics' Journal* for January, 1858.)

94. Improved Method of Cutting and Shaping Spokes; Benjamin Beale, 7, Lambton-terrace, East Greenwich, S.E.

The improvements consists in cutting or shaping the spokes while revolving round or oscillating on a centre eccentrical to the centre of the spoke. The tenons are cut, and the shaping of the spoke completed at the nave end on the same principle. This operation may be performed by placing a number of spokes at a proper angle on a sliding table, and passing them against suitable cutters. Spokes of various kinds are exhibited.

95. Patent Oil Can; John Jobson, Bulwark-street, Dover.

This invention has for its object the better regulation and insuring the supply of oil for

lubricating bearings of machinery, &c. For this purpose a tube is placed over the spout of the oil can; in this tube is a piston, which may be acted on by the finger. The spout from the lower part of the can is carried up at the side of the tube, and has an opening at the side at which the oil enters from the can. The oil so entering passes out at the end of the tube, which is in direct communication with the channel of escape for the oil.

96. Patent Lubricator; John Bailey, Albion Works, Salford.

This arrangement consists of an oil chamber placed over the bearing, the oil being allowed to flow between a needle point and a small opening in the bearing, the amount of flow being regulated by a screw.

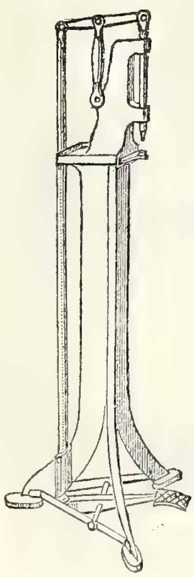
97. Hyde's Patent Vice; W. Adkins, Shadwell-wharf, Birmingham.

The sides of this vice have a parallel motion, which is given by a sliding bar, acted upon by a screw.

98. Improved Bolt and Nut; James Murphy. Exhibited by John Gedge,

This invention has for its object the fixing of nuts on bolts, or bolts in plates, in so secure a manner as to assure the nut or bolt from all movement after it shall be keyed. Each bolt is to be grooved or indented across the threads of the screw, and the nut or plate grooved or indented in like manner, and these grooves are tapped to receive a screw or plain pin.

99. Patent Foot Lever Press; R. Houchin, 7, Bridport-pl. New North-rd. Hoxton, N.



This machine is used for fixing and closing eyelets. It enables the workman to have both hands at liberty to hold and adjust the work, while pressure is obtained by the foot.

100. Improved Silk Throwing Machine; B. A. Murray, 2, Trinity-place, Trafalgar-square, W.C.

This machine produces weft in one operation, and warp or organzine in two operations from he cocoon or skein. If from the cocoon, the silk may be reeled or partly spun as experience may direct; in either case the three operations of spinning, doubling, and throwing are effected at once, and may be done with the ordinary speed of the throwing mill; the weft more speedily than in the usual way, as the machine has the novel feature that the reel taking up imparts a twist as well as the reels or bobbins giving off.

101. Patent Balanced Presser; W. Sumner, Bold-street, Preston.

The object of this presser is to equalise the strain on the thread during the time that it is being wound on the bobbin.—(See *Practical Mechanics' Journal* for July, 1857.)

102. Patent Metal and India-rubber Picker; H. Heald, Sabden Whalley, near Blackburn.

Pickers are used in weaving for the purpose of throwing the shuttle to and fro across the warp. Hitherto pickers have been made of leather, buffalo hide, or wood, but this invention consists in making the whole frame of the picker of metal, with a cushion or packing of india-rubber where it strikes the shuttle. The india-rubber is kept in its place by means of a collar or narrowing in the packing chamber, and the packing is effected by stretching the india-rubber and passing it through the collar, and then allowing it to collapse. It is stated that pickers of this description will last twice the ordinary time, and when the india-rubber is worn out it may be renewed at a small cost. By the use of this picker, the damage to the cloth, so frequently caused by pieces of the old picker flying into it, is prevented. (See *Mechanics' Magazine* for August, 1857, No. 1775, Vol. 67.) The specimens exhibited are—1. Plain calico loom picker; 2. Drop-box loom picker for weaving stripes and checks; 3. Plain calico loom picker, not packed; 4. Plain broadcloth loom picker; 5. Drop-box do. do.

103. Patent Electro-plated Printing Rollers; J. D. Mucklow, Blackford Bridge, near Bury, Lancashire.

Four models are exhibited:—1, Represents a plain iron roller or cylinder (on mandril), ready for engraving; 2, An engraved iron roller, previous to its being electro-plated; 3, A roller electro-plated with copper; 4, Electro-plated with nickel.

104. Patent Rope Machine; Archibald Smith, Princes-street, Leicester-square, W.C.

The peculiarity of this machine consists in the arrangement of the reels containing the wires

Fig. 1.

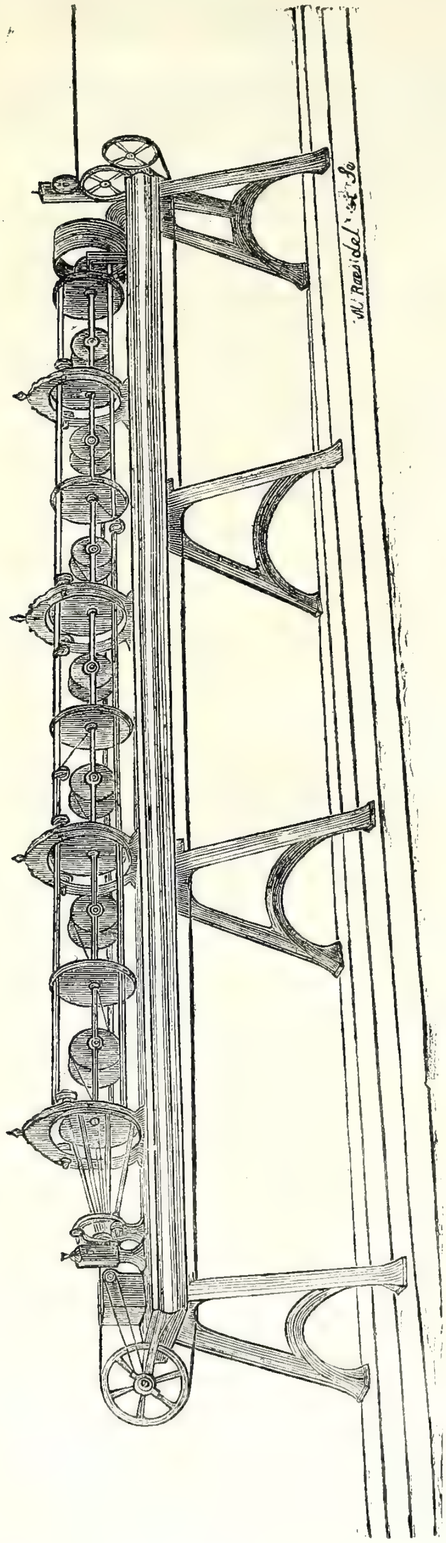


Fig. 2.

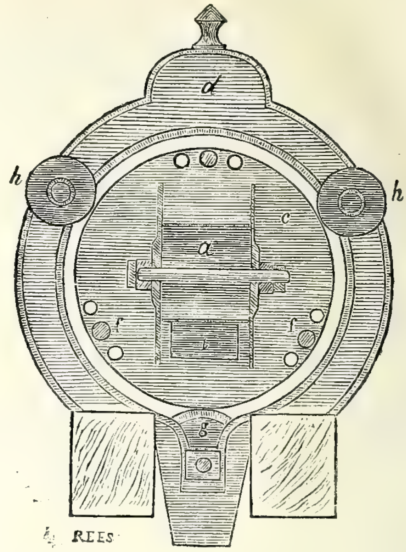
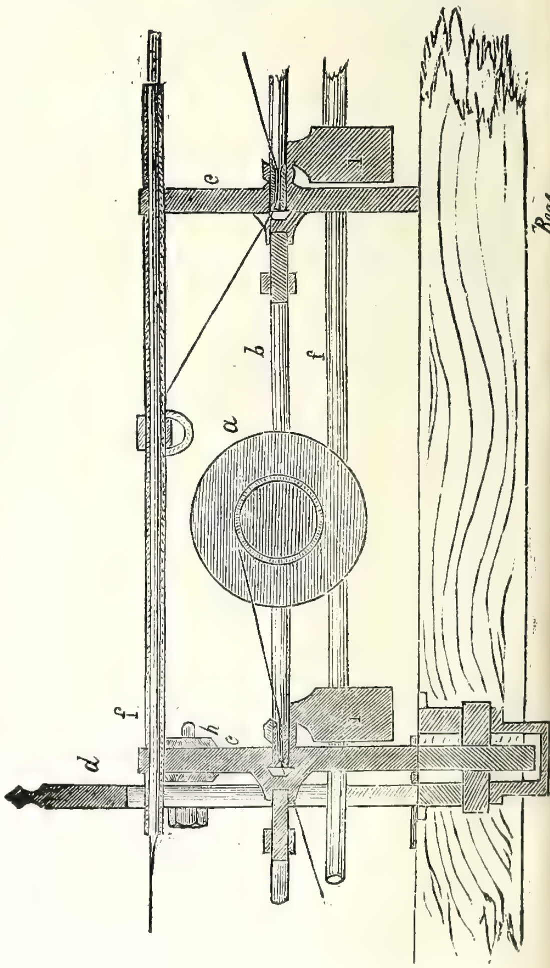


Fig. 3.



or strands, which are required to be laid together so as to form strands or ropes in the centre of a revolving frame of small diameter, in such a manner that all motion to the reels and their contents and frames, as well as all twist or tortion to the individual wires or strands is avoided. The engraving marked Fig. 1 shows a perspective view of the complete machine. Fig. 2 a cross-section. Fig. 3 longitudinal section of one compartment. A, reel containing wire or strand; B, frame for carrying the reel, mounted in bearings, in centre of disc C, and having a weight, I, attached to underside, to prevent it being carried round; C, disc with three tubular distance pieces between each pair, and bolted together by long bolts; G, roller supporting disc C; H, H, ditto, or frames D, steadying same. The machine is composed of a series of discs framed together, having between each a reel frame, as shown, and at its one end a laying plate attached thereto. This frame is driven by means of a strap, and is geared to the necessary draw-off apparatus. The wires or strands pass from reels A, through noses of frames C, and emerge by angular holes on the front sides of disc C, over small pulleys on the tubular distance pieces F, along through holes in each disc, till they reach the foremost one, thence through a laying plate to a nipper or tube. Motion being given to the frame (the bobbins, by means of the weight I, being prevented from turning), the wires or strands are laid together, and drawn off simultaneously. These machines are said to have the following advantages, viz.: a much greater speed without danger to the workmen, economy of power, less wear and tear, while the workman is enabled to see the state of the reels during the working of the machine, and thus avoid many defects in the manufacture. (See Drawings, Nos. 340 and 341.)

105. Patent Improvement in Connecting the ends of Submarine Telegraph Cables; W. B. De Blaquiere, 50, Pall-mall, S.W.

This invention consists in opening the ends of the outside wires of the cable, passing them through a circular metal wedge (or longitudinally perforated cone) and turning them back over it, the ends being secured on their own parts by wire seizings. The electric wire is then joined in the usual way, covering it with the ordinary coating of gutta percha, sufficient length being allowed to take a half or round coil with it (this is very essential, as it provides for stretching without endangering the continuity of the electric wire); it is then placed carefully in a tubular cover, divided into two segments lengthwise, the wedge or cone-shaped ends of the outer wire being so placed as to bear against the inside cone formed near the ends of the tubular cover for that purpose. The two segments of the tubular cover, filled with gutta percha or other suitable insulating substance, are then brought together and screwed up tight by means of nuts and key nuts placed at the ends, so as firmly to grip the cable and protect the part where the joint has been made. Different sized cables can be thus connected.

106. Apparatus for Paying-out Submarine Telegraph Cables; Lionel Gisborne and H. C. Forde, 6, Duke-street, Adelphi, W.C.

In this apparatus the cable is passed over a pulley, which is carried by an arm (E), (as shown in the drawing, No. 433,) suspended from a universal joint immediately over the centre of the coil, and it has also another universal joint near the pulley (D); thus the arm can oscillate in all directions, and the pulley can follow the succeeding coils in which the cable is laid in the vessel. The cable next passes under a stationary pulley (F), and then over a drum (G) (which is governed by a break), worked with levers (L^1 L^3), around which it takes several turns; the cable then passes over a pulley (H), and descends under a moveable pulley (I) which is weighted, and has a quantity of chain attached to it, and when the strain comes on the cable it draws it more and more nearly into a straight line, lifting at the same time the weighted pulley, and so becoming subjected to a continually increasing weight. The weighted pulley in its rising and falling is guided by two uprights (O O), at the upper and lower part of which there is a spring or buffing apparatus (P P), to counteract any sudden rising of the pulleys. The cable lastly passes over two guiding pulleys (M N) to the stern of the vessel. On the upper coils of the cable in the hold of the ship are placed numerous spherical weights (C), which cover the whole upper surface of the coils, and they at all times keep a slight strain on the cable, and prevent it, as it runs out, from drawing up portions of the coil with it. The weighted moveable pulley (I), mentioned above, will be so weighted with chains that when it is pulled up to the top, or nearly horizontal with the pulleys (H M), it will register the maximum safe strain on the cable; and to guard against accidents from excessive strain, the apparatus attached to the pulley (I) is furnished with a cup or box (K), which, as it ascends gradually, picks up the chain or hanging weights (L) attached to the end of the compound levers (L^1), and thus, by gradually relieving the breaks, allows the drums (G) to work more freely. The uprights (O O) may be so graduated as to register at all times the strain on the cable.

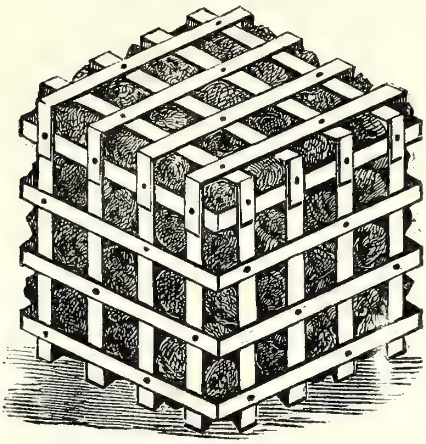
107. Patent Corrugated Grooved Wheel, for submerging Submarine Telegraph Cables, driving Machinery, &c.; C. and G. Johnson, East-hill, Wandsworth, S.W.

The periphery of this wheel has a deep channel, the sides of which are inclined at a small angle, and are corrugated. The rope to be payed out being passed round this wheel, receives a series of grips from the corrugations.

NAVAL AND MILITARY APPLIANCES.

(*For the remainder of the Articles in this Section see Drawings.*)

110. Patent Caisson de Fer, for obtaining Foundations for Marine and other Structures; E. Manico, Lieut. R.M., 4 Barge-yard, Bucklersbury, E.C.

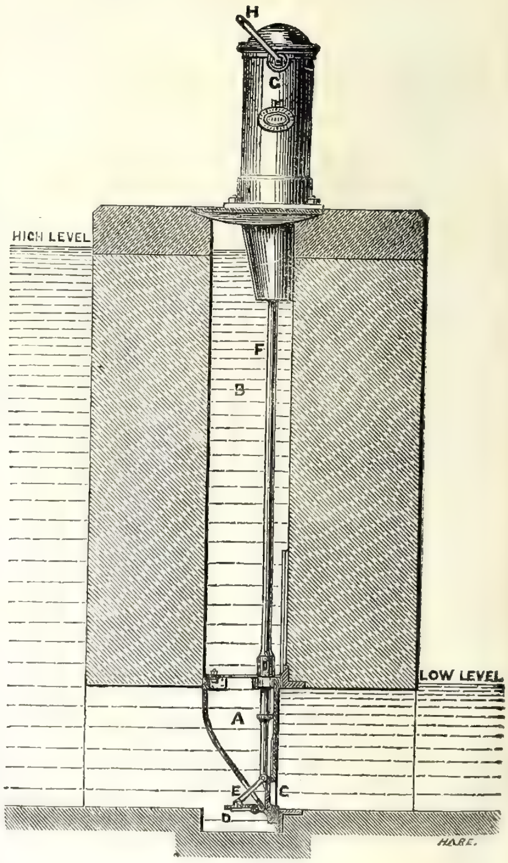


The model exhibited is on the scale of two inches to the foot. The caisson de fer is three feet square, made of three-inch by half-inch flat bar iron, put together with three-quarter-inch screw bolts and nuts, and, when filled with rough stones, and the interstices with sand, weighs upwards of two tons. These caissons de fer, possessing the power of arresting the violence of the sea, can be advantageously used on any exposed coast, for the construction of floating docks or canals, reclaiming land washed down by the sea, &c.

111. Chambered Graving Dock; Richard R. Grantham, 7, Great Scotland Yard, S.W.

This model is to the scale of one-tenth of an inch to the foot. The dock is 500 feet in length, 60 feet at the entrance gates, and 30 feet deep. It is proposed to divide it by two or more caissons, which are to be placed in the grooves. The entrance gates are those of ordinary construction. The object of this invention is to accommodate two or three vessels at the same time, according to their lengths, so that the repairs of one or more can be proceeded with while the others can be taken out of and put into dock without impeding the work or keeping one vessel waiting in dock till the other is completed. The dock may be worked by fixing the caissons in the grooves, so that when one vessel is placed in the upper chamber the water is then drawn out by sluices or other means, and the same may be done with the other chambers, and when the repairs of the vessel in the lower chamber have been completed it can be taken out and another vessel let in, while the repairs of that in the middle chamber are proceeding, and so on with the middle with respect to the upper chamber, and the water can be let in and the caissons removed to take the vessels out and to admit others. A dock of this description would almost answer the purposes of three distinct graving docks, and at the same time accommodate one of the largest class vessels. Docks divided in this manner may be extended to 1,000 feet in length, and could be made with an entrance at both ends where the locality is favourable.

112. Patent Sluice for Canal Locks; Lawrence Brothers, City Iron-works, Pitfield-street, N.



In this invention the pressure of the water against the sluice is made to assist in raising it. In the above wood cut, A is the paddle or sluice, the upper part fitting the chamber B;

C, small valve or sluice; D, small flap-valve connected with the valve C, by the link E, so that when C is raised D is closed; F, rod to machinery G; on turning the winch-handle H, the rod F is raised, opening the valve C and closing D, allowing the water from the chamber B to run off to the lower level through the opening C. The high-level water then presses in an upward direction against the sluice A, (the water in the chamber having been run off as described) and forces it upwards, the rising being regulated by the machinery G. In locks, the water is generally at the same level on either side when the sluice is required to be lowered, in which case it descends by its own weight; but, should it be required to lower the sluice against a pressure—that is, when the water is running from one level to the other—the rod F in descending closes the valve C and opens D, allowing the water in the upper level to fill the chamber B, producing an equilibrium of pressures, and the sluice is then lowered by the machinery.

113. Perforated Paddle Wheel Float; H. D. Deane, 18, Pigott street, East India Docks, E. (See drawing, No. 333.)

114. Patent Enclosed Screw, &c., for Auxiliary Steam Ships; J. M. Hyde and Co., Cumberland Iron Works, Bristol.

This screw is perfectly enclosed within the run of the ship, by sliding plates fitted into grooves, and falling like flood hatches by their own weight; it offers no resistance when the ship is under canvass, and by raising these slides it can be at once brought into use.

115. Patent Iron Masts and Yards; James Hodgson, 16, Sweeting-street, Liverpool.

In this invention the ribs are outside instead of inside, and may be made by rivetting angle iron to the plates, or by bending the edges of the plates outwards, and then rivetting them. These ribs being outside, increase the diameter of the base of the mast or column, and give greater strength. This arrangement enables the rivetting to be done by steam.

116. Finch and Lamport's Patent Iron Mast for Ships; exhibited by Finch and Heath, Bridge Works, Chepstow.

These masts are made with a joint at the deck, by means of which they may be immediately cast overboard in cases of extreme necessity, and this joint is the strongest portion of the mast under ordinary circumstances. The masts may also be made without this joint. They are said to be lighter, stronger, and more durable than ordinary masts. A full-sized section is exhibited. (See drawing, No. 332.]

117. Iron Yards for Ships, with mode of reefing and furling the sails without going aloft; Samuel Dyer, Bristol.

118. Improved mode of Reefing and Reducing Top Sails; W. A. Gilbee, 4, South-street, Finsbury, E.C.

This invention consists, first, in running lines from the reef between the head of the topsail and the fore part of the yard, and direct up to the head of the topmast; secondly, in arranging the reef tackle beneath the yard to run from the end of the yard to the quarter deck; thirdly, in the peculiar mode of strengthening the sails by bands and double ropes.

119. Improved Marline-Spike; J. Simon Holland, Woolwich, S.E.

The section of this marline-spike is oval, that of the old one being round. The improved one is a lever, as well as a wedge, for, on turning it on its axis, every time it comes flatways, between the strands of a rope, it may be pushed further in, and then, on further turning it the strands are separated by leverage.

120. Double-bodied Windlass; Samuel Dyer.

121. Improved Capstan; Samuel Dyer.

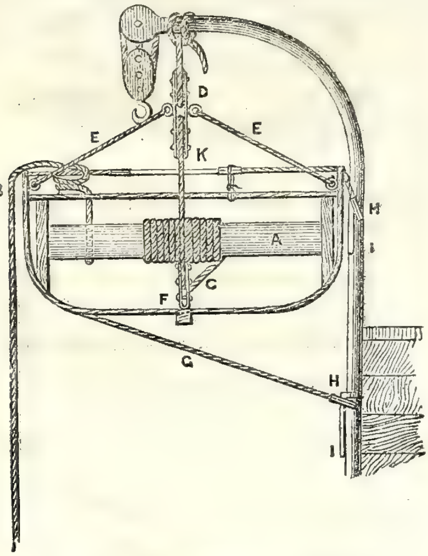
122. Improvements in Working Windlasses; G. D. Davis, 40, St. Leonard's-road, East India-road, E.

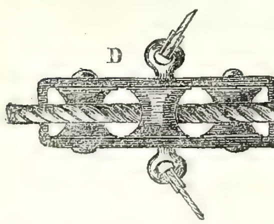
In this invention the windlass is worked by an endless chain, the links of which fit into a wheel with recesses, which hold the links and prevent the chain from slipping. (See drawing, No. 335.)

123. New Method of Lowering Ships' Boats; C. Clifford.

By this new method, lately patented, a boat laden with the full crew can be lowered in a few seconds, no matter what its weight or size, or whether the ship is at anchor or at full sail or steam. The lowering is done by one only of the crew from the boat, who, by paying off a single rope, at one time unlashes, lowers, and disengages the boat. The accompanying Fig. shows a cross view of a boat and the gear used for lowering. A is a roller which works freely in bearings at each side of the boat under one of the seats. B is the lowering rope, which is slackened off when lowering, one end of it being made fast to the roller and then wound on it a length equal to the distance the boat will have to descend from the davits to the water. C C are two other single ropes or pendants, which are made fast to the davits and pass through the 3-sheave blocks D D and the leading blocks F F; the ends of each then enter the same hole in the roller, but in opposite directions. By hauling on the lowering rope B the roller is turned round, and the pendants are wound on it a length equal to the distance the boat will have to descend to the water, and the end of the lowering rope is then made fast over a cleet on the boat's seat. D D are the 3-sheave blocks through which the pendants C C pass. They are firmly secured to the boat by a strap attached to the block F, and act like a "turn and a half" in the boat on

each pendant, breaking the strain to the man lowering, and giving him control over the descent of the boat, whatever its weight may be. The "nip" or "turn and a half" in the block on the pendant, as it passes through it, causes





the block to be dragged upwards as the boat runs down, and by making the block, to which the steadying lines E E are attached, become the point of suspense at which the boat hangs, and which is above the gunwale, thus effectually prevents its canting. The nip of the block only exists so long as there is any strain on the rope passing through it, and ceases by letting go the lowering line on the boat reaching the water. G is the ordinary gripe or lashing as altered, and made self-releasing. The gripe G is made in two parts, with thimbles at each end, the two parts being held together by a lanyard. When the boat is hanging on the pendants the gripes are passed round the boat, and the thimbles H H up the prong I I, the lanyard K is then hauled tight, and thus the boat is lashed to the ship's side. When the boat is lowered, the thimbles slip down the prongs and the boat is unlashed. The boat is raised by the ordinary tackles, which are unhooked when the lowerring gear has been rove, and the boat then hangs on the pendants. To lower, slacken off the lowering rope B, when the roller revolves and unwinds the lowering pendants, and the boat descends at any speed regulated by the man attending the lowering rope, and at whatever point of contact the boat touches the water, letting go the lowering rope releases it, as the ends of the pendants not being fastened to the roller, but merely put into a hole in it, unreeve themselves.

124. Single Pillar Revolving Davit; C. Clifford.

This davit is for stowing and lashing boats securely on deck, and getting them quickly outboard. It has a single stem or pillar, from which two arms branch out at an obtuse angle to each other, and from the extremities of which perpendicular bearings support the boat at any desired distance from its ends. The boat, securely stowed and lashed inboard over the deck, is, by one half turn only of the davit, thrown outboard over the ship's side, unlashed, ready for lowering.

125. Patent Wrought or Cast Iron Hollow-studded Cable Chain; W. & M. Bayliss and Co., Wolverhampton.

The chief advantages of this chain consist in the yielding property of the hollow centre stud, it being found that the solid stud, when an excessive strain is put upon the chain, acts as a lever, and occasions a breakage of the link.

126. Patent Safety Apparatus for Preventing Boats from Capsizing; M. Grouse and Co., 549, Oxford-street, W.

This consists of an arrangement of a pair of tie-rods and a rope, which suspend a weight at a considerable depth below the keel of the boat. The tie-rods being hinged to the sides of the boat, allow the weight to be raised as the boat approaches the shore.

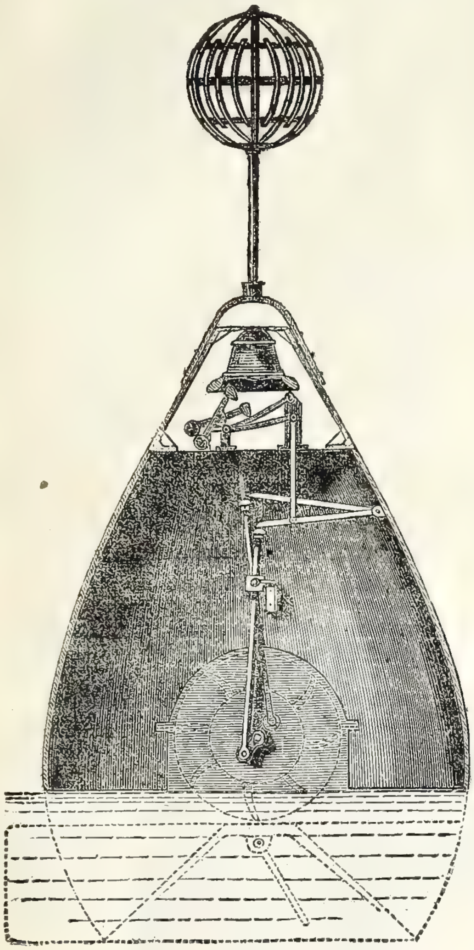
127. Patent Signal Apparatus, for communicating from the Deck to the Engine Room; George Hornsey, Southampton.

This apparatus, which is placed in a convenient part of the Engine Room, consists of a Dial which has marked on its face the various words of Command, such as "Stop," "Ahead," "Back," &c. This dial is mounted on a shaft, which may be rotated so as to bring any particular word or signal thereon, opposite an opening in the face plate of the apparatus. A bell is placed in the interior of the apparatus, which is sounded at each movement of the dial. Motion is communicated to the apparatus by means of suitable gearing connected with an iron column placed on the bridge or paddle-box. On the top of this column is an index, corresponding to the dial plate in the apparatus.

128. Bell Buoy; G. W. Lenox (Brown, Lenox and Co.), 8, Billiter-square, City, E.C.

This invention consists in applying an undershot water-wheel, in the centre of an iron or other buoy, through which a pipe or watercourse is made, the lower or downward paddles of the wheel being driven round by the water passing through the trough. At each end of the spindle of the water-wheel is a crank, which works an apparatus arranged in such a manner

as to constantly ring a bell, which is fitted on the top of the buoy, so long as the current runs through the water-course. The alarm will thus be given to all vessels approaching dangerous reefs or shoals in tide-ways, in dense fogs, calms or dark weather, for upwards of 22 hours out of the 24. The same description of wheel can be fixed in a frame, and being thrown over the stern or side of a light vessel can be made to act in a similar manner.

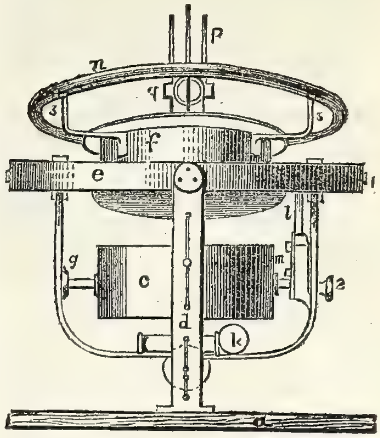


129. Engine Room Telegraph; Perreaux and Co., and T. Suffield.

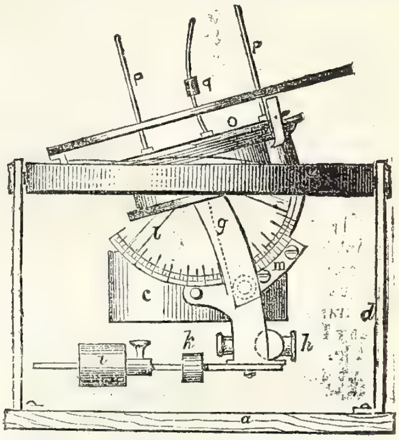
This is for the purpose of communicating directly between the captain or officer in charge and the engineer.

130. Patent Mariner's Time Compass; Ralph Reeder, 41, Southampton-buildings, W.C.

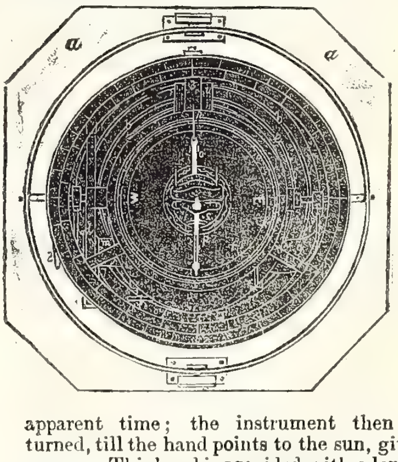
This instrument, which is a combination of a universal dial and chronometer, has been constructed to take any horizontal bearing in any latitude, at any hour of the day. It is also intended to solve those problems which can be solved by an armillary sphere, or by spherical trigonometry—so far as its circles and their motions extend; and it will be also found to supply the place of the magnetic needle. For



taking an horizontal bearing in any latitude, let the hour be what it may, it is only necessary



in the first place to bring the hand, with its two upright wire standards at the ends, to the true



apparent time; the instrument then being turned, till the hand points to the sun, gives the course. This hand is provided with a lens fixed in the centre, which takes the place of the gnomon of the universal dial, and is carried round by the chronometer once in 24 hours—

the focus from which being thrown on the equatorial circle gives the true time. For finding the true apparent time of any place and taking its angle, the instrument should be levelled and elevated to true latitude, and adjusted to the meridian; the hand will then steadily point to the sun and follow it in its course; or when the lens casts its focus on the proper point, it will be found to give the true apparent time; and conversely, if the instrument be levelled and elevated to the true latitude of the place, and turned round horizontally until the hand (which is first fixed to the true apparent time) points to the sun; the lens at the same time will cast its focus on the proper point, and being adjusted to the meridian of the place, any angle or bearing may be laid down by a horizontal graduated motion. By having the declination given, and the time, the instrument will show the altitude and latitude; or, having the declination and the meridian given, it will show both the time and latitude of any place at any hour of the day. The instrument will be found to act as a substitute for the magnetic needle, by means of the shadow of the wire standards before mentioned. When the hand of the timepiece is placed to true apparent time, and turned round to the sun, the shadow of the wires will fall singly, and light refracted from the lens will be thrown on the equatorial circle at the true time of the place, and the figures 12 and 12 will stand north and south on the timepiece and on the equatorial circle, and the error of the needle will be apparent at once, and the time given by the dial can be easily converted into longitude; whilst the graduated arch will show the latitude, by adding or subtracting the sun's declination as the case may require. The moon or fixed stars may be used, by any easy adjustment of the instrument, for ascertaining course and longitude by night. The north star may be used also to ascertain course and longitude. To effect this, the standards that support the timepiece should be so placed as to range with the North Star, which will cause the figures 12 and 12 on the equatorial circle and timepiece to correspond therewith; the instrument will then be found to stand north and south. The instrument having been thus adjusted, to find the longitude by the North Star, it is only necessary to point the hand to one of the stars, the position of which is known, and when the wire standards fixed upon the hand points to the star, beneath the hand, on the dial, will be found its true apparent time, and by comparing it with the chronometer's time, longitude is easily found by the known methods. To facilitate the taking of observations by this instrument, the lens placed in the centre of the dial-plate is so arranged as to admit of easy elevation and depression to suit its being adjusted to the sun's declination. The dial and compass of the instrument are made to oscillate upon their axes.

131. Compass Lantern; J. Vardon and Sons, 3, Gracechurch-street, E.C.

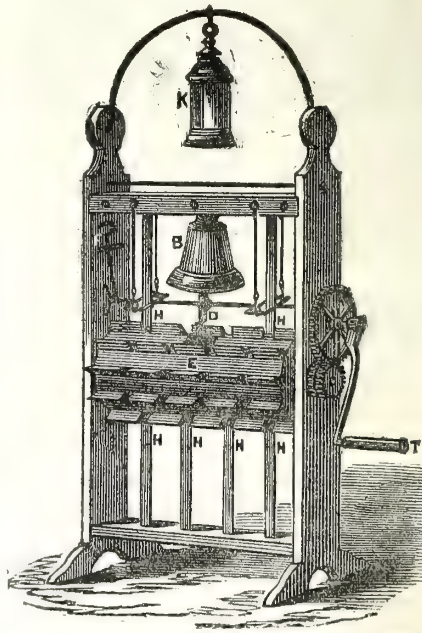
This instrument combines the ordinary compass with a hand-lantern.

132. **Patent** Ship, Signal, and Harbour Lamp; J. Weir, D. and G. G. Brown, 25, Wickham-terrace, New Cross, Deptford, S.E.

The lenses used in the construction of these lamps possess the property of diffusing light, instead of concentrating it, like the ordinary circular lenses. In the lamp with the circular lenses the light is not visible, unless the eye be kept directly in the focal point of the lens. The shape of each lens is square, presenting three flat surfaces posteriorly, the central broad, the side narrow, whilst anteriorly, instead of being round throughout its course, it presents three convexities, the middle broad, the side narrow, corresponding to the flat posterior surfaces. From the centre of each of these convexities the lens is flattened off in four directions, viz., upwards, downwards, and laterally. Each lens has four sides or edges; by means of the upper and lower it is fixed in the frame work of the lantern, and by the lateral or perpendicular edges, which may be mitred to any angle, so that any number of lenses may be placed side by side, it is joined to its fellow without the use of metal work beween tthem, and the corresponding sides of each lens, when joined, form a lens. The signal lamp shows light with the same brilliancy from all points. To effect this, the lamp is constructed of seven or more of the above described lenses. Three colours are used—red, white, and green, each lamp having its own separate colour. The mast-head and side lamps are constructed on the same principle.

133. Masthead and Ships' Lamps; G. and J. Oliver, 286, Wapping High-street, S.E.

134. Patent Ships' Fog Signals; W. H. Myers, 202, Whitechapel-road, E.



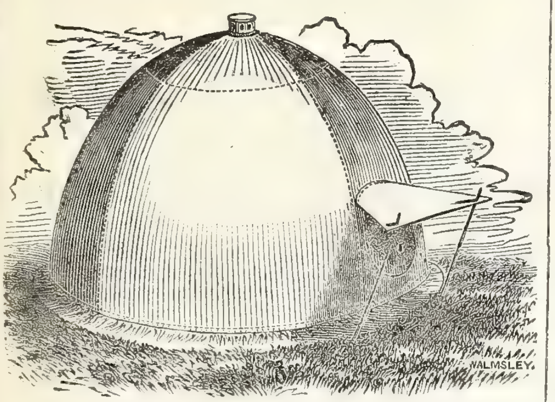
B Bell. C. The Tappet. D The Hammer of Bell.
E Revolving Toothed Cylinder.
F Pawl or Catch. H Springs. T The Handle. K Lantern

This apparatus is intended to be used on board sailing vessels during fogs at sea. When steering in one direction, by turning a handle a bell can be sounded, and when steering in the opposite direction, a very powerful rattle can be put in motion by turning the same handle, the bell ceasing to sound when the rattle is in action, and *vice versa*.

135. Self-acting Ice Indicator. Exhibited by N. M. Cummins, Annmount, Cork.

The object of this invention is to indicate to navigators the proximity of floating icebergs, when by reason of fog or darkness they are not visible. A small stream of water is allowed to flow into a vessel through a tube, in which a theometric rod is mounted. One end of this rod is fixed, while the other is free, it being intended by its contraction and expansion to work a lever connected with an alarum. The free end of the rod is jointed to the short arm of the lever, and thus the amount of its contraction beyond a certain limit is multiplied sufficiently to set the indicating apparatus in action. Whenever, therefore, the vessel approaches an iceberg, the inventor states that the decreasing temperature of the water in its neighbourhood (for a distance ranging about two miles) will cause the thermometer rod to contract and set the alarum in action.

136. Hospital and Field Tents; Capt. G. Rhodes, 94th Regt., Chatham.



The canvas of this field tent is supported by radial ribs, the upper ends of which are secured to a central head-piece, provided with sockets to receive them. The lower ends of the ribs enter loops in an endless circumscribing cord or ground rope, which is pinned to the ground by tent-pegs. The hospital tent is constructed on a similar principle, and may be made of any required dimensions. A ridge-pole is introduced between two head-pieces, which are carried by radial ribs, and bent ribs are passed upwards from the looped ground-rope to fit into sockets attached to the ridge-pole. (See Drawings, Nos. 338.)

137. Military Field Stabling; T. D. Rock, 8, Napier-street, Wellington-street, Islington, N.

The model exhibited represents, on a scale of one inch to a foot—1. A waggon six feet high, to which the stabling can be attached. 2. Three tubes of galvanised iron, fitting into rings and sockets, each two feet above the top rail of the waggon. 3. Three tubes with solid points fixed into the ground, parallel to the last-named, at a distance of seven feet and a-half from the waggon, and standing six feet and a-half high. 4. Two tubes of eight feet in length, connecting each of the three uprights. 5. Three tubes eight feet and a-half long, uniting the uprights, fixed in the waggon with those at a distance of seven feet and a-half in the ground. 6. A covering of light water-proof canvass, enveloping the whole frame-work, and pegged to the ground like an ordinary tent. 7. A small tin manger, hung from the rail of the waggon, to hold the corn. By this arrangement on both sides of the waggon, four horses can be readily accommodated. On the march, the tubing and canvass are to be strapped to the sides of the vehicle. The additional weight per horse is about 32lbs. The model shows the tent as erected for use, and as packed for transport.

138. Patent Mortar; Captain T. A. Blakely, R.A.

The peculiarity of this mortar consists in the whole being made in concentric layers, each slightly compressing that within it, so that when the strain comes, all may be strained nearly equally. In a cast mortar the interior must be strained much more than the exterior. It is stated that this arrangement gives greater strength at a cheaper rate, and affords facilities for making ordnance of a size hitherto found to be impossible.

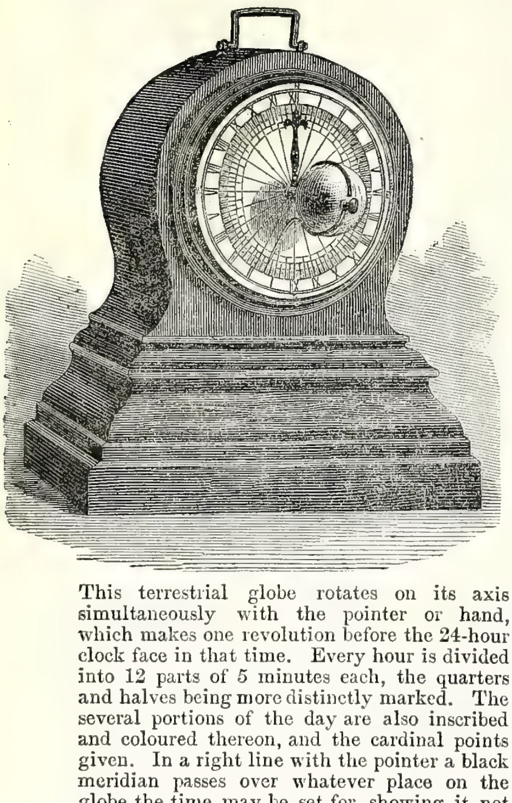
139. Improvement in Fire-arms; Charles Farrow, 18, Great Tower-street, E.C.

This invention consists in attaching to the soldier's rifle a small instrument, which by the pressure of the finger, holds the end of the cartridge while it is torn off, thus obviating the necessity of biting it. The simplest form of this instrument is shown attached to an Enfield rifle, and models of other forms are also shown.

PHILOSOPHICAL APPARATUS, &c.

(For the remainder of the Articles in this Section see Drawings.)

150. Time Globe, or Planetary Clock; T. Sherratt, jun., 12, South-square, Gray's Inn, W.C.



This terrestrial globe rotates on its axis simultaneously with the pointer or hand, which makes one revolution before the 24-hour clock face in that time. Every hour is divided into 12 parts of 5 minutes each, the quarters and halves being more distinctly marked. The several portions of the day are also inscribed and coloured thereon, and the cardinal points given. In a right line with the pointer a black meridian passes over whatever place on the globe the time may be set for, showing it not only there but at all other places under the said meridian. On turning a button, which projects through the circular opening of the glass cover, it will cause the white meridian attached at the south pole of the globe to move over any place.

151. Patent Chronometrical Thermometer; W. H. Gauntlett, South Bank Iron Works, Middlesboro'-on-Tees.

This instrument is designed for the purpose of indicating the temperature of the atmosphere, and of permanently recording its variations upon a strip of paper by means of a marker. The strip of paper is rolled upon a drum, set in motion by clockwork. The marker obeys the impulse conveyed to it by the thermometric tubes, which expand or contract as the temperature varies. The strips of paper are ruled with lines. The horizontal lines represent the thermometric scale, the vertical lines correspond with the hours of the day and night, as shown in the accompanying diagram. When the drum has completed its revolution, a line will be found inscribed on the paper intersecting the hour lines, and the thermometric lines also, if there has been any variation in the temperature, and this inscribed line will show what the temperature has been at any moment of the day or night. This instrument is specially applicable for horticultural purposes.

152. Astronomical Clock; Chr. Lange, 9, Salisbury-street, Strand, W.C.

This clock has a free escapement, with the pendulum suspended above the movement, the object of this being to make the pendulum more independent of the movement than usual. The compensation is so constructed that it can be regulated without difficulty. The suspension is so constructed, that, in case the suspension-spring should break, the pendulum cannot fall down.

153. Patent Reversible Hunting and Open-face Watch; F. B. Adams and Sons, 21, St. John's-square, E.C.

154. Time Indicator for use at night; Meyer Drukker, 47, London Wall, E.C.

This is an arrangement for showing the hour at night by means of the shadow thrown on to a scale, from an index attached to the weight of a clock.

155. Improved Surveying Level; Pastorelli and Co., 208, Piccadilly, W.

The peculiarities of this instrument are—an improved tripod or staff head; the substitution of a ball-joint and clamp for the ordinary parallel plate screw; an improved mode of suspending the telescope; the adjustments are rendered less liable to derangement; and there are improvements in the arrangement of the diaphragms.

156. Metford's Improved Levelling Staff; Pastorelli and Co.

157. Metford's Pocket Scales; Pastorelli and Co.

158. Improved form of Warrington's Microscope; Pastorelli and Co.

159. Set of Meteorological Instruments; Pastorelli and Co.

This set of instruments consists of a barometer, maximum and minimum thermometers, dry and wet bulk hygrometer and rain guage.

160. Froude's Proportional Compasses; Pastorelli and Co.

The peculiarity of this instrument is this, that it can at once be set not only to any known ratio, but to any ratio which is not known, but which is only indicated by the length of two given lines; the instrument being set, the value of the ratio can be immediately ascertained by referring to a graduated scale.

161. Decimal Measures of Length; J. Simon Holland, Woolwich, S.E.

These measures are founded on the 16th of an inch as the basis. The two rules are marked wth the present inches and eighths. The fathom measure is 1,000 "steens," or sixteenths, long, and intended for the use of surveyors, builders, &c. Ten of these new square fathoms coincide with the present rod of brickwork, or equal to 271·28 of the present square feet; and 1,000 of these new fathoms make a new mile, of which 69·99886 make a degree of the meridian. Bulk measures, founded on the cubes of these length measures, are exactly four times the French bulk measures. The new gallon will, therefore, exactly equal four litres. (See *Mechanics' Magazine* for March 27, 1858.)

162. Perspective Models; E. L. Paraire. Exhibited by George Rowney and Co., 51, Rathbone-place, W.

These models are intended for teaching the principles of perspective. The objects are solid, as in nature; lines passed from their various points represent visual rays, which intersect a transparent plane, pourtraying the picture, which corresponds with mathematical accuracy to the object itself, the manner of obtaining the vanishing points and other perspective operations being clearly shown.

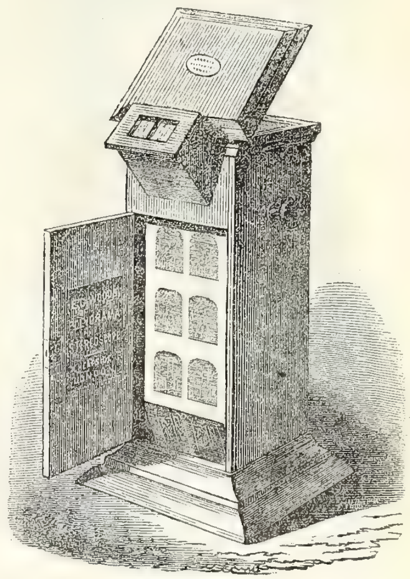
163. Stereoscopic Camera; Alexander J. Austen, 2, St. John's-hill, Battersea-rise, S.W.

This camera is stated to possess the following advantages:—1. It can be worked without a dark room or tent. 2. It has a new arrangement for securing the bed of the camera being perfectly level. 3. It has a shutter instead of a cap, which can be opened and shut without shaking the camera. 4. There is an arrangement of various-sized diaphragms, on a circular disc, fixed on the camera, instead of loose ones. 5. It has an arrangement to enable the radius rods to be easily fixed, so as to obtain the coincidence of the two pictures, according to their distance, without the necessity of frequent shifting from side to side as at present.

164. Patent Dioramic Stereoscope; E. Erskine Scott, Dundee.

In this instrument the double eye-piece is so arranged that the rays from the two pictures come to the eyes as if they radiated from a point of medium distance, such as that at which we are in the habit of looking at natural objects. This improvement is effected by using in the eye-piece two entire lenses, and placing their centres a little further apart than the distance betwixt the eyes of the observer, so that the rays from each picture are slightly refracted outwards.

165. Polyorama Stereoscope; E. G. Wood, Cheapside, E.C.

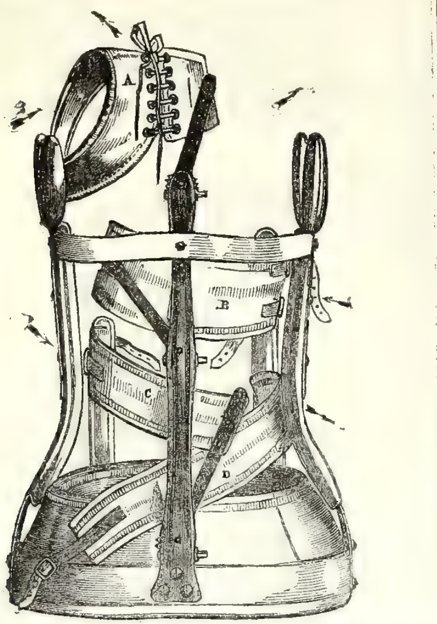


This consists of an upright rectangular-shaped box, rising from an ornamented base, having at one side a sloping box, containing a pair of prismatic stereoscopic lenses. The top of the instrument can be raised to any required angle, and as the inside of this is lined with silvered glass, any required degree of light can be thrown upon the pictures, which are placed below in the axis of the lenses. Across the box is fixed a square block, reaching from side to side, and turned round by moving the brass head on the outside. This block, by means of a spring and notched wheel, can be moved exactly half of a revolution at a time. The pictures are formed into an endless band, and hang upon this block, and are brought in succession before the lenses.

166. Patent Photogen, or Light Generator, to be used for taking Photographs at Night; John Moule, Hackney road, N.E.

This apparatus consists of a convenient arrangement for burning pyrotechnic compositions for taking photographic portraits at night, at the same time preventing the noxious vapours from escaping into the room. The admission of air is so arranged as to prevent the vapours from obstructing the light emanating from the burning composition. The vapours pass from the top of the apparatus through a tube into a chimney.

167. Spinal Apparatus; Bernard Brodhurst, F.R.C.S., 20, Grosvenor-street, W.



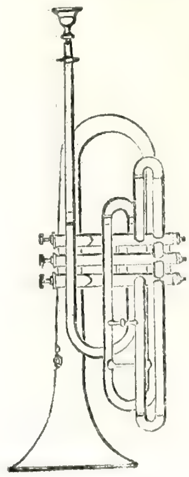
The arrows attached to the engraving denote the directions of the applied forces:—A. The shoulder sling. B. the dorsal, C. the lumbar, and D. the pelvic webbing bands.

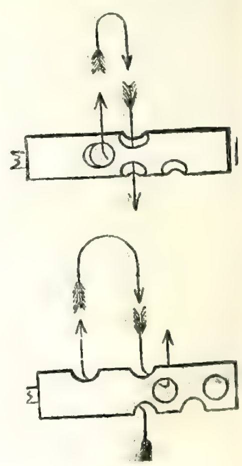
This apparatus is composed of a pelvic belt, having two lateral uprights, the superior extremities of which terminate in crutch-heads, which, placed in the axillæ, support the shoulders. These lateral uprights may be elongated at pleasure. They also rotate on their inferior extremities at their attachments to the pelvic belt by means of screw-centres. A perpendicular steel bar (vertebral stem) is affixed to the centre of the posterior segment of the pelvic belt, and is carried as high as the upper extremity of the dorsal spinal curve; it is united near its upper extremity by means of a transverse band (scapular band) to the lateral uprights below the crutches. This forms a solid frame, which cannot be tilted when lateral pressure is applied, as generally happens to other spinal instruments. The vertebral stem supports three levers, all of which are moved by rack and pinion joints. The lowest of these gives attachment to the webbing band, which supports the convexity or which depresses the superior extremity, as the case may be, of the lumbar curve. The middle lever gives attachment to the webbing band, which supports the convexity or which raises the lower extremity of the dorsal curve, as it may be a primary or a secondary curve. And the upper lever is connected with the shoulder sling, which sling being applied to the shoulder and embracing the scapula and the ribs which correspond to the upper extremity of the dorsal curve, acts upon the curve to unband it. The sling is composed of stout linen, enclosing gutta percha, which is accurately moulded to the form. Further, the lumbar and dorsal webbing bands are attached in front to two perpendicular levers, which are placed on the anterior segment of the pelvic belt and which are moved, as well as the posterior levers, each by a ratchet-wheel motion. Also, a webbing band is connected with one of the anterior levers, and passing over the highest ilium is fastened to the opposite side of the pelvic belt. The action of the instrument is as follows:—When the dorsal is the primary curve, its convexity is supported by the webbing band, while the upper extremity of the secondary or lumbar curve is depressed by the oblique action of the lumbar band, and the superior extremity of the dorsal curve is upraised by the action of the upper or cervical lever on the shoulder and side of the thorax. The resistance which is thus obtained has generally been overlooked in other spinal apparatus. But should the lumbar be the primary curve, its convexity is supported by the lumbar webbing band, which is attached to the lowest lever, while the resistance is gained by means of the webbing belt which passes over the ilium; and the curve is unfolded by uplifting the lower extremity of the dorsal curve by means of the webbing band attached to the dorsal lever. When much rotation of vertebræ is superadded to lateral curvature of the spine, a metal plate with several ratchet motions is attached to the vertebral stem of the instrument, by means of which pressure can be made from behind forwards. And when a cervical curve has to be treated mechanically, an instrument formed on the same principle may be applied, being firmly attached to the neck and shoulders, while the extending force is applied to the mastoid process of the occiput, at the same time that the convexity of the curve is supported.

168. Patented Improvements in Artificial Teeth; J. Maurice, 306, Regent street, W.

This invention consists in the application of vulcanized or mineralized India rubber as a lining to the gold or bow frame, and as a covering to the fastenings used for securing artificial teeth in the mouth. This is said to secure a more accurate fit, and to give a better support to the teeth.

169. Improved Cornet-à-Piston; Joseph P. Oates, Erdington. Exhibited by Thos. Dawkins, 7 and 8, Little Warner street, Clerkenwell, E.C.





The improvement in this instrument consists in the construction of the valves for changing the direction of the current of air from the main wind-way into the supplementary ones, by means of which the various intonations, termed the valve notes, are produced. By this arrangement of the openings in the pistons, the direction of the passage of the current through them in producing the valve notes is made so entirely to assimilate with that of the open notes, that the quality of tone and correctness of tune of these notes are identical.

170. Revolving Pianoforte Hammer; E. Thompson, Brigg.

The head of this hammer is circular, and is covered on every part of its circumference, in the same manner as the ordinary hammer is covered at the point which strikes the wire. When worn at one point it may be made to revolve on its axis, so as to bring another part into use.

171. Elliptical-fronted Pianoforte Keys; H. Brooks and Co., 31 to 34, Cumberland-market, Regent's-park, N.W.

AGRICULTURAL IMPLEMENTS, MACHINERY, &c.

(For the remainder of the Articles in this Section see Drawings.)

180. Patent Horse Hoe; John D. Garrett. Exhibited by Garrett and Sons, Leiston Works, Saxmundham, Suffolk.

The old arrangement for adjusting the mortice-bar by hand, or by hand and levers, is shown on one side of the model, and the improved method on the other; the latter shows the mortice-bar supported at its opposite ends, by joining to it pairs of pendent rods or levers, which, in proportion as they are opened out or brought nearer together, raise or depress the mortice-bar, and effect the desired change in the angle of inclination of the hoes. The raising or lowering of the mortice-bar is accomplished as follows:—the screw-shaft must be turned by means of the winch-handle, which projects beyond and in rear of the framing; the rotation of this shaft will cause the nuts on the pendent-rod or lever to approach to or recede from each other, and thereby increase or diminish the space between the mortice-bar and the framing of the implement, by which means the angle of the inclination of the hoes to the ground will be changed as desired. The principle of this hoe is, in all other respects, the same as was patented by Mr. Garrett, senior, in the year 1843.

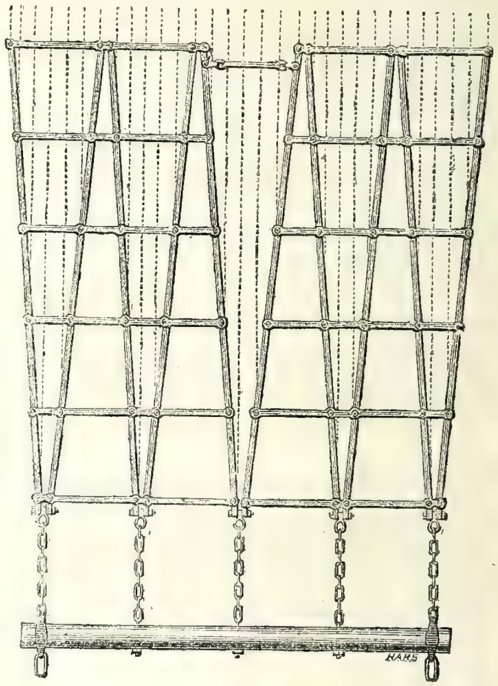
181. Agricultural Steam Machinery: William Hawkes, Eagle Foundry, Birmingham.

In this invention the tractile power acts, in a direct line, upon the implement to be moved, the engine being placed lengthways in the line of draught. Two drums, of large diameter, are worked alternately by a pinion being made to engage alternately in spur wheels on the drums. The implement is drawn backwards and forwards across the field by means of a rope or chain, working over a snatch-pulley attached to an anchor-carriage placed on the opposite side of the field. The engine is upon wheels at right angles to its longitudinal axis, and both the engine and anchor-carriage are moved, from time to time, by means of chains made fast at one end, and coiled over pulleys worked by the engine.

182. Model of a Farm, under Burcham's Circular Method of Tilling Land by Steam or Horse-power; C. Burcham, Heacham, Lynn, Norfolk, and 8, Upper John-street, Golden-square, W.

This system of agriculture subdivides the entire farm into small plots or circular allotments (either half acres or acres). A steam-cultivating platform is then made of a length suitable for executing any required operation by a circular sweep over the surface of each plot.

183. Patent Harrow; J. Emery.



The chief novelty in the construction of this harrow is in the wedge-like arrangement of the tooth-bars, and the mode of gearing them to the whippletree. All the teeth in the harrow are brought into longitudinal rows, in alternate cross parallels, a position that greatly favours an equal and effective action of the harrow on the soil. The arrangement also admits of such a mode of gearing to the whippletree that every tooth in the harrow has the full force of the draught direct upon it. The model exhibited, and the annexed woodcut, represent a light seed-harrow for one horse.

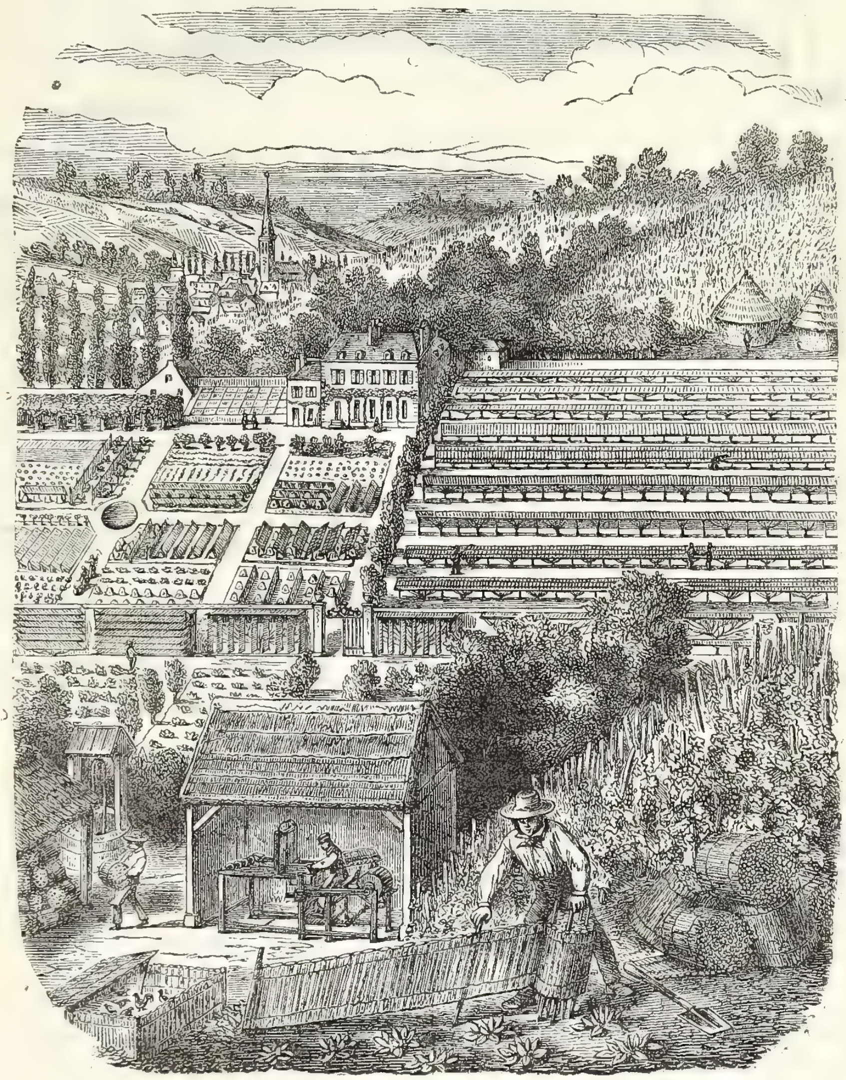
184. Patent Steam Cooking Apparatus for Cattle Feeding; George Forsyth, Stakeford Foundry, Dumfries.

In this apparatus there are two boilers, the outer one being set in brick-work, in the usual manner, and the inner one of similar shape, but smaller, inserted inside it. Water is conveyed into the space between the two boilers, and the roots, or other food to be steamed, are put into the inner boiler, and rest on a perforated false bottom, and are covered close with a lid. Fire being applied, and steam raised (which will

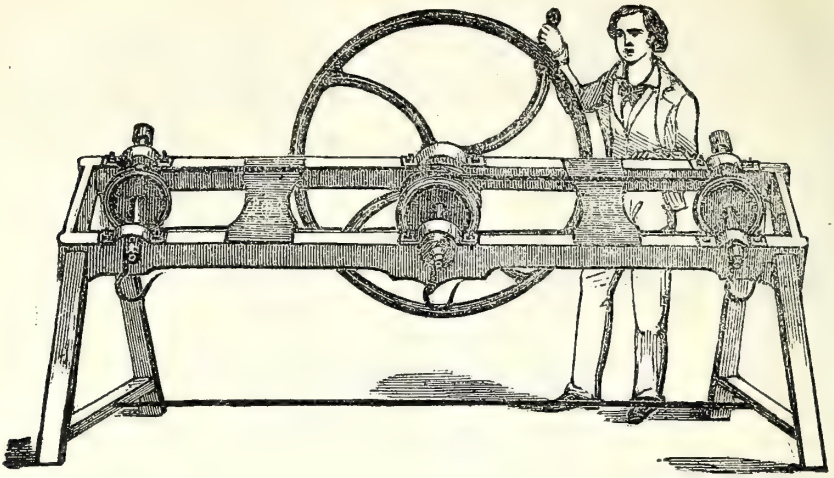
blow off at a safety-valve when about 3lbs. pressure), it will pass to the under side of the false bottom, and rise through it to the roots. This boiler, when made large enough, will not only supply the steam necessary for preparing the food placed in it, but will also cook food, in a separate vessel, placed alongside.

185. Dr. Guyot's Patent Straw Mat Weaving Loom; Agent, S. Sidney, 24, Great George-street, Westminster, S.W.

This apparatus consists of two parts, a frame and comb for separating the straw into the required quantities for the weaver, and a two-treadled loom, by means of which wires are bound round the straw, so as to form it into continuous bands. This loom can be worked, after a few hours' practice, by a boy of twelve years old, or by a blind man or woman. The material, knotted together with iron wire, forms an endless roll of matting or thatch, which may be economically applied to all purposes to which hand-made straw mats or thatch are applied; to shelter fruit trees, or early vegetables or flowers, from frost—to rapidly cover ricks without the assistance of the skilled labour of the thatcher —to protect brick or stone work from frost during erection—to provide a cheap and rapidly erected shelter for ewes and lambs on open downs, or for live stock at agricultural shows. In France this machine has been found very useful, as producing a cheap protection for vines. The annexed woodcut shows a variety of applications of it.



186. Patent Straw and Hay-band making Machine; J. H. Simpson, Petersham.



This machine consists of an oblong cast-iron frame supported on four standards; in the centre of the frame a hollow shaft, with fly-wheel and double pulley, revolves in bearings. From the double pulley fixed on the shaft, power is taken, by means of ban ds, to two other pulleys of the same diameter, fixed on the hollow shafts revolving in bearings near each end of the framing. At the outer extremities of the shafts, are the hooks to which the hay or straw is attached. Under ordinary circumstances the hooks do not revolve, although the shafts to which they are connected may be revolving; but as soon as the straw or hay is attached, and the "drag"—made by the operator as he walks outward from the machine—put on, the hook is pulled outwards till it engages with a catch on the driving shaft, and it immediately partakes of its motion; on the "drag" being stopped, the hook is pulled out of connection with the catch of the shaft by means of a spring. By this arraangement three separate lengths of bands may be made, and as the hooks are not in motion when no bands are attached, should one operator be finished with his length before the others, he can commence a new attachment to the hook without necessitating the stoppage of the other two.

187. Patent Adjustable Scythe; James Payne, Kirkcudbright.

This scythe is adjustable by means of nuts and screws, and is so arranged that the blade will shut up like a knife. The short handles are moveable up and down the snaith, and fixed at any particular place by simply screwing them round with the hand. (See *Practical Mechanics' Journal*, June, 1857.)

188. Horizontal Wind-mill; David Davis, Woodchurch, near Tenterden.

This mill has four horizontal sweeps, with shutters, which spontaneously shift so as to be driven round by the wind, whatever quarter it may blow from.

189. Improved Wirework; John Reynolds, 57, New Compton-street, Soho, W.C.

This wirework possesses greater strength than that usually made, it being made of hard twisted wire, and galvanised after being manufactured. It is intended for fencing of all kinds. From the way in which the twisted wire is interlaced, no other fixing is required.

190. Improvements in Stops for Gates; Andrew Scott, 15, Charlotte-terrace, Islington, N.

This gate stop is arranged so as to rise and fall as the gate is closed and opened. There is also an arrangement for closing the hole which receives the bolt, to prevent it from becoming clogged when the gate is open. This is accomplished by a suitable combination of gearing connected with the hinge and gate-post.

191. Patent Ledge Drain Pipes; John W. Milnes, 389, Strand, W.C.

These drain pipes are constructed with a ledge and tongue at the joints, so as to prevent the pipes from sinking unequally.

192. Patent Watering Pot; William Palmer, 156, Western-road, Brighton.

This invention consists in making the rose of a watering pot of an oval form with a convex surface, and perforating it with fine holes and attaching it obliquely to the mouth-piece. There is also a percolator, of a cylindrical form, with small holes, which is inserted in the flow-pipe, preventing the rose from becoming choked.

193. Bar and Slide Hive; W. B. Tegetmeier, St. James-lane, Muswell Hill, N.

This hive consists of two or more boxes, each furnished with loose moveable bars, for the attachment of the combs, and slides. It presents all the advantages of an ordinary bar hive, with the great practical convenience attending the use

of slides. Two boxes are stocked with a swarm, the slides being withdrawn from the lower one, and, when they are filled, a third shallow box is placed above for virgin honey, and communication made by withdrawing the slides. The loose bars afford every facility for partial removal of honey, artificial swarming, and scientific observation, and the slides, which obviate the necessity for a cover, enable storifying, top feeding, and the removal of full honey boxes to be easily accomplished.

194. Stewarton Bee Boxes. Exhibited by W. B. Tegetmeier.

These hives are used extensively in Scotland. a swarm of not less than 5lbs. in weight, or two smaller swarms, being placed in two boxes. When both are filled, a shallower honey box is placed above to receive virgin honey, communication being made by withdrawing the slides of the middle box. In very productive seasons, a fourth box is required below.

BUILDING, SANITARY, AND DOMESTIC APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

200. Proposed Improvement of the Banks of the Thames; J. F. Wieland, Rossbank House, Port Glasgow.

These models are intended to show a section of the scheme proposed for an embankment of the Thames, a removal of the London sewage, an extension of the wharfs and quays, a new road from the west to the City, a subterranean railway from Charing-cross to London-bridge on the north side, and on the south side the same advantage except with respect to the railway, which would be one, as shown in smaller model, to connect the South-Western and South-Eastern Railways

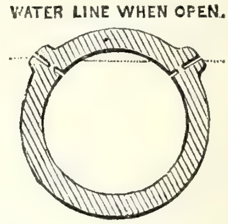
201. Arch constructed of Patent Cement; C. C. and A. Dennett, Nottingham.

202. Improved Method of Laying the Footings of Brick Foundations; John Harrisson, 3, High-street, Homerton, N.E.

In this arrangement the external angle bricks are 9 in. square and 11½ in. square, which prevents their being removed like the common 4-inch brick. The set-offs are made on every alternate course.

203. Patent Opercular, or Lidded Pipes; Henry Doulton, High-street, Lambeth, S.

The invention consists of two flanges, or ribs, running lengthways, and comprising about one-third of the circumference of the pipe; through these flanges a partial incision is made before burning, in such a manner that, at any time, by inserting a chisel in the groove, the segment included between the ribs can be readily detached, without any risk of fracture or damage, either to itself or to the remainder of the pipe; and, after examination, the lid or cover so detached is easily replaced, and, from having been burned in one piece, this lid fits exactly into its original position. By this contrivance access can be obtained, if necessary, to any part of a drain, or even to the whole length if required, without in any way disturbing the pipes in their bed, or lessening their capacity; a junction can be inserted, or the lid of a pipe removed without fracture or injury, and this is effected without increasing the number of joints or allowing any escape of the liquid contents, or entry of the surrounding soil. The strength of the pipes is increased by the addition of the flanges or ribs.

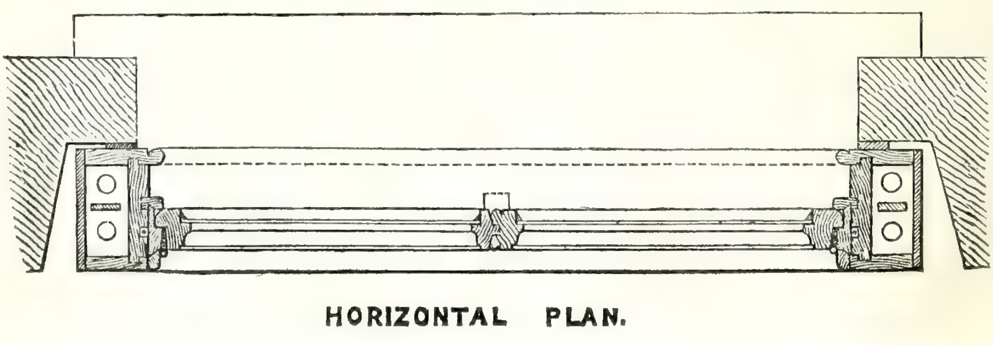


Cross Section.

204. Cleansing Tube for Drain Pipes; John Harrisson.

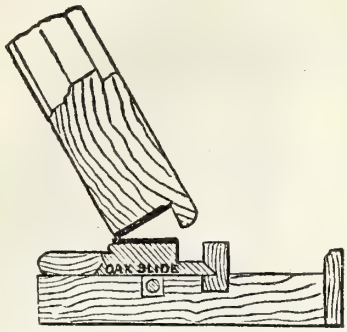
These tubes can be laid with the ordinary drain pipes at convenient distances, and have an opening in the side 20 inches long, covered with a complete flange, so that cement joints can be made. The sides of the tube are brought up sufficiently high for the complete diameter to be preserved.

205. Patent "Oak Hall" Window; West and Hubbell, 25, Rupert-st. Haymarket, W.



HORIZONTAL PLAN.

In this window the upper half of the sash slides down to the bottom, and the lower part is in two halves, and may be raised as far as required, or opens up like a door. When



SECTION OF OAK SLIDE & BOXING

shut one bolt secures them all. They are so hung as to be less liable to accident than ordinary windows, as the sash cords, &c., are thoroughly protected from the weather.

206. Patent Self-Acting Sash Fastenings; J. Decimus Tripe, Commercial-road, E.

The peculiarity of these fastenings consists in their having a metal joint so constructed as to prevent rattling of the sashes, allowing a self-acting lever to lock the sash when the window is closed. A second arrangement consists of a self-acting lever, which, when placed in position on one sash, inpinges against a stop or stops fixed at different heights on the style of the other sash.

207. Patent Window Sashes; Dick and Co., 1, New Inn-buildings, Strand, W.C.

This is an arrangement for allowing the window sashes to be renewed or taken out for cleaning, &c., without removing the beading.

208. Improved Sash Window; Benjamin Shaw, Wellington, Salop.

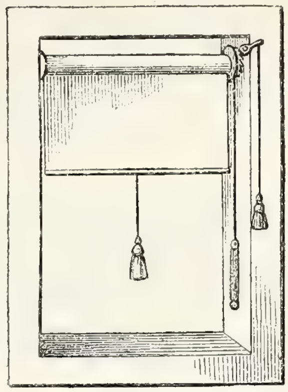
This window is so arranged that the outside of the window may be easily turned inwards, so as to enable it to be cleaned within the room.

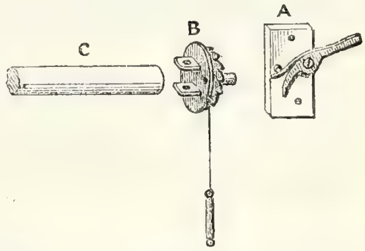
209. Patent Trellis Lath; Fairclough, Brothers, Liverpool.

This window lath, for hanging curtains, consists of a row of cross levers joined together, each portion of which opens and closes at equal distances, thereby giving regularity and evenness to the folds of the drapery in every position. It likewise raises the curtains from the floor and folds them one over the other in the middle when drawn.

210. Patent Elastic Spring Blind Roller; White and Bull, St. John's-square, E.C.

This invention consists of a pulley, having a drum smaller in diameter than the roller of the blind, and attached thereto by two arms, a ratchet being cut in the outer edge of the pulley, for a catch to work in, which is fixed to the bracket, in which the pin of the roller revolves, a small cord being fastened to the drum of the wheel, and the other end attached to an india rubber spring, which is then fixed to the side of the window frame.





A. Bracket and catch. B. The Pulley-wheel, showing the method of attaching it to the roller by the arms. C. Portion of roller.

211. Patent Register or Chimney Valve, and Improvements in the Construction of Fireplaces; E. A. Spurr, 3, Newton-road, Bayswater, W.

The chief features of this invention are, a solid brick, arch-built, through the whole thickness of the wall, thereby adding to the strength, and removing one of the causes of a smoky chimney, viz., the large open space immediately over the fire; the commencement of the flue at the crown of this arch, and affixing to the lower part of it, either built into the brickwork or attached to the ironwork of the stove, a new kind of register or valve.

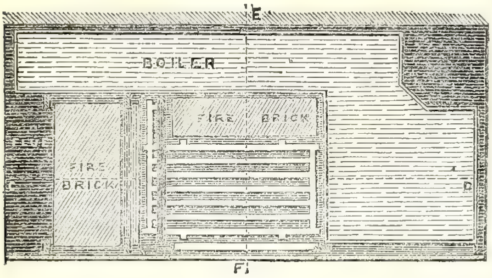
212. Improved Fire-Bricks; J. M. Paine, Silica Works, Farnham.

213. Improved Grate with porcelain sides, fire-brick back, and regulating damper; F. Edwards, Son, and Co., 42, Poland-street, Oxford-street, W.

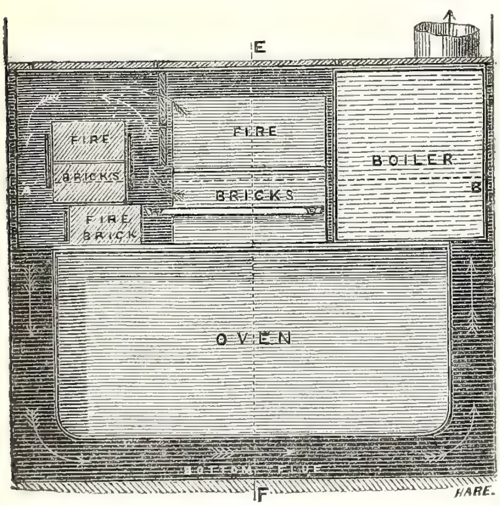
This grate is intended to show the application of porcelain to grates in the least expensive manner; the price of the specimen one shown, with either of the pattern tiles, being scarcely more than that of a common register grate.

214. Patent Economical Model Lodging House Kitchen Stove; J. Cundy. Exhibited by Wm. Addis, 6, Leicester-street, Leicester-square, W.C.

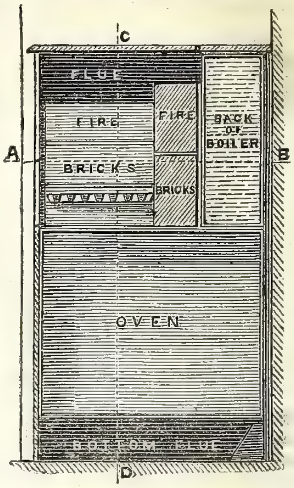
This stove embraces in a compact form an oven 18 inches long, 11 inches high by 14 inches deep, a boiler which will contain three pails of water, an open fire 7 inches long, 9 inches high, by 6 inches deep, the top of the stove forming a hot plate for the purpose of stewing, boiling, and heating irons. The stove exhibited is 24 inches long, 24 inches high by 14 inches deep.



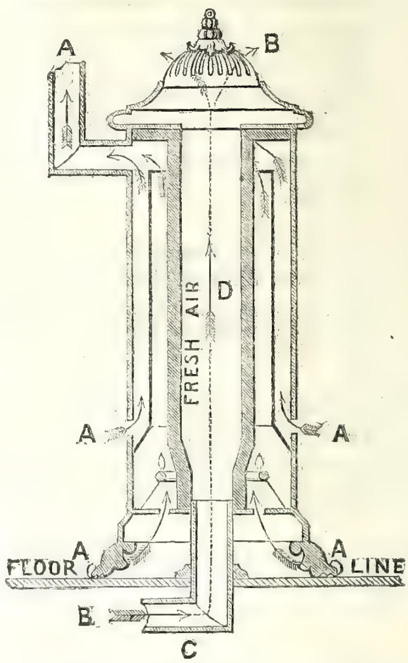
The above plan shows the arrangement of the stove above the oven. The fire-bricks which form the left-hand side and back of the fire-place are moveable in case of breakage; these bricks impart the heat they extract from the fire to the top of the oven.



The above longitudinal section shows the action of the stove when the oven is in process of being heated; the arrows indicate the passage of the products of combustion over the bricks down the left-hand flue of the oven, under the oven and from thence up the right-hand flue into the chimney, by which arrangement the oven becomes equally heated over the whole surface. The following cross section shows the relative positions of the oven and boiler, also the construction of the fire-place from front to back. The 4-inch pipe which connects the stove with the chimney is fitted with a damper, to economise fuel when the oven is not in use. A 24-inch stove will cook 30 lbs. of meat, besides vegetables, at the same time.



215. Patent Sanitary Gas Stove; J. Cundy. Exhibited by Wm. Addis.



In the annexed woodcut, which shows a vertical section of the stove, the arrows A indicate the course the vitiated air of the room takes in its passage through the stove into the chimney; D the earthenware cylinder through which the external air ascends into the room at a warm temperature; C the pipe to conduct the external air into the earthenware cylinder.

216. Deflagrating Gas Stove; F. X. Kukla, 194, Pentonville-road, N.

This is an adaptation of the principle of the Davy lamp to the construction of a gas stove.

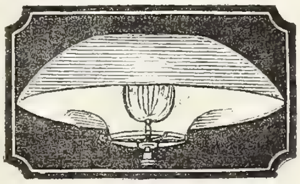
217. Opal and Coloured Glass Gas Fittings; W. Reichenbach, 33 and 34, Borough-road, Southwark, S.E.

These glass fittings have metal tube linings, to give additional strength; the branches are also joined directly on to the stem, thus avoiding the necessity for the introduction of a dish as in the ordinary gaseliers.

218. Patent Petrolene, or Liquid Gas Lamps; Nibbs and Hinks, Hockley-hill, Birmingham.

This lamp is constructed to burn almost any description of hydro-carbon; but that to which it is particularly adapted is "Young's Patent Mineral Oil." The cone and shade-holder are cut by machinery from one entire piece of metal, and the other parts are so arranged as to cause no accumulation of heat. This lamp can be lighted instantly.

219. Deflecting Shade for Gas and other Lamps; Nibbs and Hinks.



The lower part of this shade is of clear glass, and the upper part is coated with enamel; it is thus made to serve the double purpose of a shade and a deflector.

220. Patent Crystal Lamp Burner; Nibbs and Hinks.

This invention consists of a glass cone placed over the wick, which throws the oxygen into the flame at a higher point than usually done. Outside this cone is placed an ordinary shouldered chimney, the shoulder of the chimney causing a second current of air to be deflected to the flame at some distance above the cone. This second current of air is supplied through four slots in the glass-holder.

221. Deflecting Ventilator; Nibbs and Hinks.

222. Smoke-preventing Chimney Cap; Nibbs and Hinks.

223. Maltese Chimney Cap; John Leighton, 40, Brewer-street, Golden-square, W.

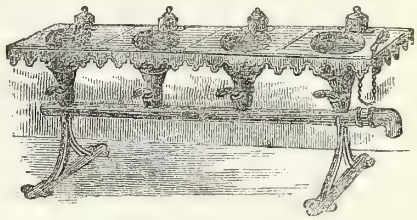
This is intended to prevent downward draught, and regulate the discharge of smoke.

224. Chimney Top; William Sandilands, Inveresk, Midlothian, N.B.

225. Patent Burglary Detector; T. Turner, Wolverhampton, and City-road, E.C.

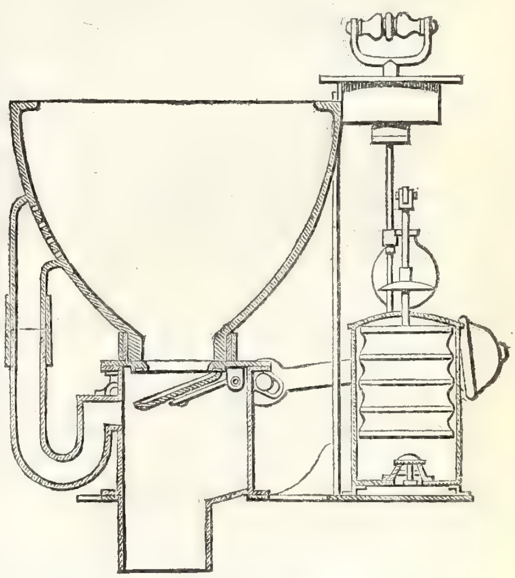
This apparatus is intended to be fixed upon the mantle-piece in a sleeping room. Wires are attached to it, and conveyed to doors, windows, &c., and there is an arrangement of cranks for setting a bell in action, as also for striking a light, on any entrance being made to the house.

226. Patent Wash-hand Range; Walter McFarlane and Co., Glasgow.



This apparatus consists of a range of basins, the whole being constructed of cast iron. It is intended for schools, reformatories, barracks, &c.

227. Regulator Valve Closet: Charles Botten and Son, Crawford-passage, Ray-street, Clerkenwell, E.C.



In fixing this closet, all that is necessary is to set it on an ordinary trap, bringing a supply pipe to the union of the valve. As no service-box, cranks, or wires, are required, this pipe maybe branched from any main pipe in a building, and a number of closets supplied from one cistern, which may be at any distance therefrom. The bottom valve shuts against a ring of thick India rubber bedded into a metal seating, preventing leakage from unsoundness of valve. A perfect flush of water is obtained, no matter how carelessly the handle is pulled or suddenly let down.

228. Improved Water Closet; D. H. Lamb, Berwick.

This closet has the seat constructed like a chair, with an upright back for the support of the cistern, which cistern fills by a self-acting valve-tap for high or low pressure, each time the closet is used. The cistern cannot freeze, as it is always empty except when in use. It can give any quantity of water each time it is used.

229. Mode of Utilising and Deodorising Sewage Matters, &c.; Dr. John Lloyd, Llangefni, Anglesea.

This invention consists in applying the sifted ashes or breeze and the cinders from fire-places, alone or in combination with quick-lime, and in certain cases assisted by small quantities of chloride of lime, to remedy the nuisance produced by the sewage of houses, and thus reduce it to an inoffensive state, to be easily removeable with such refuse, and so to be used as manure. The patentee proposes to use, inside of closets, &c., moveable metallic receptacles, of a square shape, divided by a partition, so as effectually to separate the solid from the liquid deposits. The ashes and lime rapidly solidify, and even fossilize the solid deposits, and convert them to masses without smell. The front compartment of the closet it is proposed should always, if possible, be partially filled with the mixture of lime and ashes. It acts in this manner:—the quantity of liquid passed into the closet forms a mass of wet lime, which acts in its well-known capacity of absorbing gases by deodorising any offensive smell. A great part of the liquid thus passed into the closet is at once absorbed, and any excess of it filters through the mass of lime and carbon, through a pipe to the sewer, and by so doing becomes divested of nearly all foreign matters, passing off as lime water, with only a very small proportion of impurities, and in a state that the ordinary putrefaction and smell are rendered impossible.

230. Improved Coal Cellar Plate; John Harrisson.

Cross ribs are fixed on the under side of this plate which prevent it from being shifted without raising it sufficiently to clear the ribs.

231. Patent Marine Lock; W. P. Mills, Forest-hill, S.E.

This is a tumbler lock, so constructed that the mode of picking (by means of what is termed a double action) is prevented. It differs from all other tumbler locks in having the spring formed out of the tumbler itself.

232. Spring Lock; W. P. Mills.

In this invention the key hole is covered by a piece of card or soft metal, the catch of the bolt passing through a slot cut in it, and by means of a private mark at the back of this piece of card, papers or valuables under such security are prevented from being tampered with.

233. Patent Lock; W. Bond Paul, Langport, Somersetshire.

There are three important features in this lock. 1st. The bolt and tumblers cannot be reached simultaneously. 2nd. No impression of the tumblers can be taken whereby a false key could be made. 3rd. The bolt is not acted on directly by the key, so that the length of the bits has no reference to the distance the bolt is thrown, and consequently the key for any lock, however large, may be made conveniently small. This lock has a slide of peculiar form, and a second stump to the bolt. The key, which fits into a pipe, places the tumblers in the position for unlocking by passing under one end of them. To this pipe is fixed a lever which acts both on the bolt and the slide. During the rotation of the key, and consequently of the pipe, the slide is drawn over the tumblers and shuts off all access to them; the lever then passes on to the bolt, which can be reached by the lever only. The stumps are so placed that the lower one cannot be brought into contact with the tumblers until the other has entered a slot in the slide, which it cannot do whilst any part of the tumblers is exposed. The tumblers have all the same outline, so that when the bolt is locked they lie perfectly flush with each other. During the process of unlocking they are held up by friction.

234. Patent Invalid Bed; Wilson, Newton, and Co., 144, High Holborn, W.C.

This bed has a mechanism for raising the patient, to enable the bed to be made, as well as for placing him in any required position with the least possible inconvenience.

235. Invalid Couch; Thomas Greenacre, Millwall, Poplar, E.

This combines a bed, easy chair, leg-rest, &c. The back-board can be set to any angle. As the back rises or falls, the arms keep level. The leg-rests can also be raised or lowered either together or separate. The India rubber bed is made in separate compartments, so that its rigidity may be regulated.

236. Nightingale Bed; Thomas Dixon, 7, St. James's-place, Hampstead-road, N.W.

237. Stand for Cheval and other Dressing Glasses, Fire-Screens, Easels, &c.; Henry Dolman, 10, Nelson-street, Greenwich, S.E.

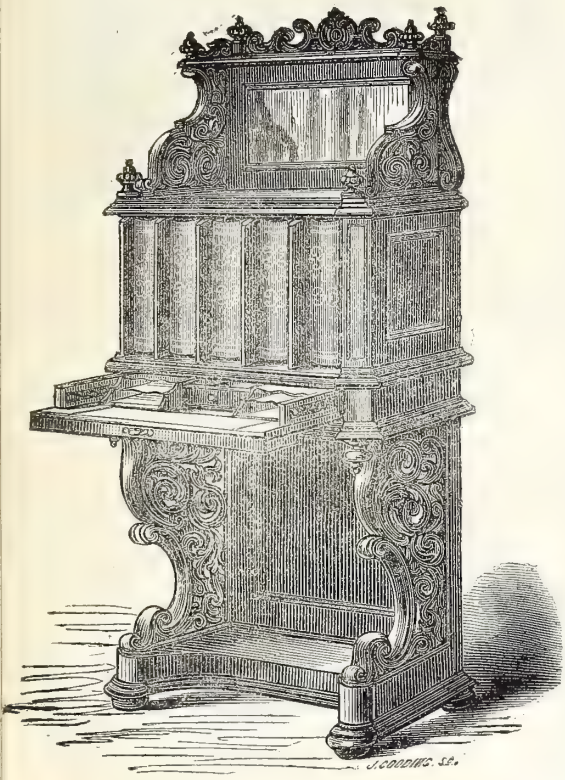
This invention consists of a hollow pillar rising from a base or foot; inside the pillar is a rod, on

the front of which is a toothed rack, which is worked upwards or downwards by means of a toothed wheel on a spindle, with a handle outside the pillar; the spindle is provided on the outside of the pillar with a ratchet wheel and fall, to keep the rod at the required elevation. The top of the rod is provided with a boss and cross-bar, acting vertically and horizontally, so as to place the glass or other object in any required position.

238. Patent Nursing-Chair; Wilson, Newton, and Co.

239. Exercising Apparatus for Infants; J. Clifton, 541, Oxford-street, W.

240. Music Canterbury, with Writing Desk; H. Brooks and Co.



241. Patent Dining Table Expander; Fairclough, Brothers, Liverpool.

This model shows a principle by which any length of table may be opened and closed by the application of a short screw. Nuts are fixed in the backs of the slides, and each one being acted upon successively by the turning of the handle the table expands to its full extent. In closing, each slide runs off on a neck at the head of the screw as the succeeding one is drawn up. The advantages possessed are that there is no weight of screw or tube in the centre of the table when opened; and, only one of the slides being acted upon at a time, greater freedom in working is secured.

242. Patent Mangling and Calendering Machine; J. Chedgey, the Grove, Southwark, S.E.

The peculiarity of this machine consists in the application of glass as its bed, the rollers being also made of the same material. The rollers, it is stated, have borne a pressure of 30 tons, and are ordinarily worked under a pressure of 10 tons. The reversing motion is effected by a lever and cam. A machine on this principle has been in use in the Queen's laundry for some time past.

243. Patent Glass Rollers and Cylinders; J. Chedgey.

244. Patent Box Mangle; Richard Howland, 3, Long-lane, City, E.C. Exhibited by Davies and Hunt.

The principal novelty is in the lift, which is self-acting, and is put in operation by pressing a knob in front of the frame, thereby obviating the danger of reaching over the mangle whilst it is in motion. The iron work is so arranged as to pack into the box for convenience of exportation.

245. Washing, Wringing, and Mangling Machine; Thos. Briggs, 173, Woodhouse-lane, Leeds.

246. Patent Washing Machine; J. L. Hancock, 62, Pentonville-road, N.

This machine consists of a water-tight case, in which rollers are placed near the bottom, carrying an endless canvass band, to which various loops are fixed. The articles to be washed are partly drawn through these loops. A third roller presses by its weight upon the top of one of the others, and consequently upon the articles as they travel round the band. The case is to be filled up to the lower edges of the rollers with hot suds; the articles should be soaped before being placed in the machine.

247. Spring Balance Washing Machine; Peter Gabbitass, Worksop.

This machine consists of a cylindrical tub, a spiral spring, a wooden horse, and revolving knuckled rubbers.

248. Patent Washing Machine; Thomas Robson, 15, Critchill-place, Hoxton, N.

249. Knife-Cleaning Machine; G. Weadon, 41, Poland-street, Oxford-street, W.

250. Opal Glass Rails, for Counting-house Desks, &c; W. Reichenbach.

MISCELLANEA.

260. Patent Elutriator, for Decanting Wine, &c.; Charles Farrow, 18, Great Tower-street, E.C.

261. Patent Decanting Machines; Wm. Lund, Fleet-street, E.C.

262. Patent Rack Corkscrew; William Lund.

263. Patent Lever Corkscrew; William Lund.

264. Patent Spherically-jointed Pocket Corkscrew; William Lund.

265. Patent Clips for Holding Papers, Music, &c.; William Lund.

266. Fastenings for Bullion Boxes; William Lund.

267. Patent Bullion Box; Samuel Montagu.

The object of this invention is to prevent the withdrawal of the contents of the box without detection; this is effected by grooves being made near the edges of the box into which iron plates are driven. When the plates are on the box nails are driven through them, indenting the iron into the wood, and preventing the plates being forced off without so injuring them and the box as to render it impossible to replace them. The ends of the boxes are dovetailed, and spaces left between the plates, so as to prevent any attempt at sawing out the sides along the grooves.

268. Patent Bread-making Machine; E. Stevens, 5, 6, and 7, Cambridge-road, London, N.E.

269. Patent Mincing Machine; S. Nye and Co., 79, Wardour-street, Soho, W.

This machine consists of a series of blades placed upon an axis, and forming an endless screw. The meat is cut and forced out of the machine by one operation.

270. Apparatus for Beating the Whites of Eggs, &c.; E. P. Griffiths, 8 High-street, Camberwell.

271. Domestic Apparatus for Making Ice Creams; George Keith, Great Russell-street, Bloomsbury, W.C.

This apparatus is to be used with ice and salt only.

272. Australian Freezing Apparatus; George Keith.

This is intended for making a small quantity of dessert ice, by means of freezing mixtures, or ice and salt.

273. Domestic Coffee Roaster; George Keith.

This is to be used on the top of an ordinary fire, with an arrangement for fixing it on the bars of a grate.

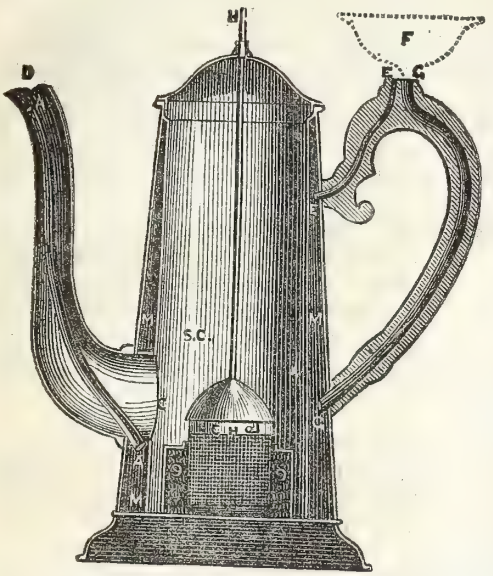
274. Toaster for Cooking; George Keith.

275. Patent Double Chamber Coffee Pot, for holding Milk and Coffee in separate Compartments; W. H. Myers, 202, Whitechapel-road, E.

This coffee pot is formed by a case fixed within a case, the inner one holding the coffee, the outer one the milk; at the bottom of the inner case is formed a perforated compartment to receive the holder, having a connecting rod attached to it through the top of the pot, in which

holder the ground coffee is placed; inside this holder can be placed an Archimedean screw by which chocolate can be torn to pieces and agitated. The heat, instead of radiating from the sides of the pot into the air, goes into the milk, warming it previous to its being poured out. The same application is made to tea-pots, for holding milk and tea in separate compartments; and, in a modified form, for spirits and water.

FIG. 1.

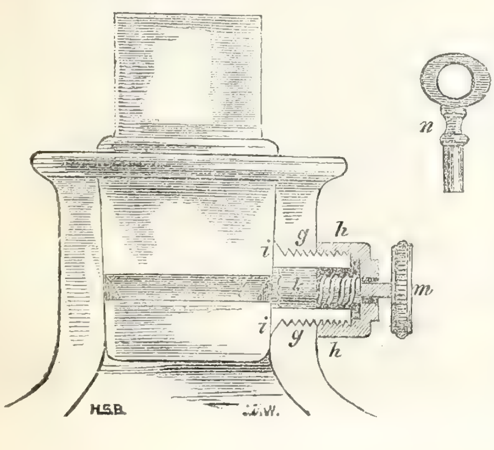


S C Inner Case for Coffee. M M Outer Case for Milk.
C H Perforated Holder or Strainer for Ground Coffee.
T The Lid which forms F the Funnel. G Milk Inlet.
A A Milk Outlets. D Coff e Outlet
E Inlet and Outlet for Air. H Connecting Rod.
9 9 Perforated compartment for Coffee Holder.

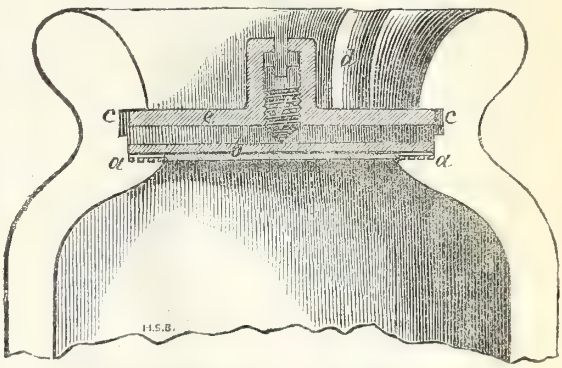
276. Improved Kettle; Taylor and Rolfe, Northill, Bedfordshire.

This kettle has a concavity at the bottom, within which are several tubes, through which the water circulates.

277. Patent Locked Poison Bottles, Locked Air-tight Jars, Spirit Bottles; Stevens and Fitch, 56, Great Queen-street, Lincoln's-inn, W.C.



The annexed woodcut shows the construction of these bottles, &c.; *k* is a bolt or plug passing through a tube *gg*, secured by a cap *hh*, with an eyelet or key-hole; *m* a moveable key that screws on the bolt *k*; this bolt being pointed to lodge in grove *l* in stopper *ii*, by pulling the key in an outward direction, it forces back the coiled spring on bolt *k*, and allows the stopper to be removed; placing the stoppers in the bottles forces the spring back and locks itself; the key being unscrewed, the contents of the bottle are secure. As merely placing the stopper in the bottle causes it to lock, it is evident the spring must be drawn back every time the bottle is used.



In the mouth of the jar, the ledge *aa* receives a lid or cover *b*, with a layer of cork on the underside; the bar *e* is passed into the mouth of the jar by means of the slot or opening *d*; when turned onwards to the groove *cc*, it is in its place. The screw *f* is worked up or down by means of a key passing through a key-hole on the top of the bar and fitting to the screw; screwing down forces the cover *b*, and imbeds the cork on the ledge *aa*. Working the screw up, relieves the bar, and it may be moved round to slot *d*, and taken out.

278. Patent Cornucopian Feeder; Henry Edwards, 1, Bishopsgate-street Within, E.C.

This invention is intended for administering food or medicine to the sick or to children. It is also applicable for giving medicine to cattle. A patent air stopper is adapted to it, which regulates the flow of liquid.

279. Patent Arabica (Lentilised) Cocoa; Samuel Riley, Stamp Office, Oldham.

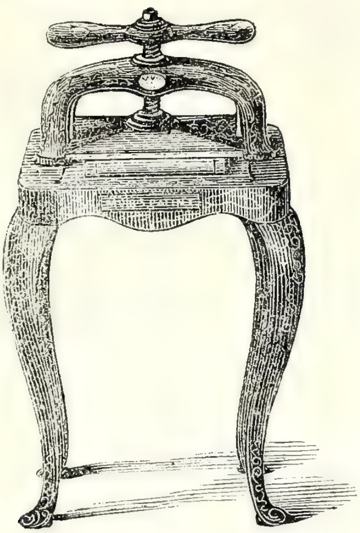
This article is mixed with lentils in lieu of the flour of wheat, rice, sago, tapioca, and arrowroot, the ordinary ingredients of the best commercial cocoas. Its chief property consists in its possessing a large amount of albuminous matter in proportion to that of oily matters.

280. Postage Stamp Distributor; S. Denham, Wakefield. Exhibited by Thos. G. Iveson, 60, St. Peter's-road, Mile End, E.

This instrument is intended for the delivery of postage or other stamps singly to purchasers, so as to dispense with the attendance of an official for this purpose at post and receiving offices. One penny being put into

the hole near the top, unlocks the instrument, and allows the handle on the left to be pulled out; this, on being pushed in, sets in motion two rollers, through which a string of stamps passes from a supply roller, forcing out one to be pulled off. One stamp only can be had at a time, and halfpence or smaller coins are rejected.

281. Patent Letter Copying Press; William Muir and Co., Britannia Works, Manchester.



In this press the stand and press are made in one piece, so that the complete machine can be made at less cost than hitherto. This arrangement is found advantageous for exportation, as no timber is used. The legs can be easily taken off, so that it may be packed in a small compass.

282. Patent Ready Index Ledger; J. Raven and Co., 46, Fish-street-hill, E.C.

283. Patent Pocket Watch Fastener; Robert Mair, Edinburgh.

This consists of two segments of thin steel, fitting round the periphery of the watch, and intended to be worn in the pocket. There is an arrangement of hinges and a catch, by which the watch may be released when required.

284. Patent Lock for Brooches: John Long, Tiverton.

In this arrangement a spring catch passes over the end of the brooch pin, and must be drawn back by the finger in order to unfasten it.

285. Osmont's Patent Pocket Reservoir Penholder. Exhibited by E. Stevens, 5, 6, and 7, Cambridge-road, N.E.

The penholder in this case becomes the reservoir for the ink. Within the holder is a double threaded screw upon which a piston works. By turning this screw so as to draw the piston up the holder, the reservoir is charged with ink, which is supplied to the pen as required by turning the screw and driving down the piston.

286. Fountain Pen; J. Needham.

This pen-holder consists of a tube, having a cap, which, when screwed on, is ink-tight. At the opposite end is a conical nose-piece, in which the pen nib is enclosed. The nib is fixed to a stem having a helical spring coiled round it, which presses against a shoulder on the stem, a little larger than the internal diameter of the nose piece; this forms a valve, keeping it air-tight. When in use, the point of the pen is pressed inwards, thus opening the valve and allowing the nose-piece to be filled. When the supply is exhausted, the pen is again rudimentarily pressed inwards to renew the supply.

287. Steel Parasol Frames; Alexander Porecky, 7, York-street North, Hackney-road, N.E.

These frames are made in two ways; either the slider and stretchers and the pivots by which they are joined to the ribs, may be made in one piece, while the ribs are joined by a perforated ring; or, the ribs and top-ring may also be made in one piece.

288. Patent Vest Shirt; Robert Atkinson, 1, St. Nicholas-square, Newcastle-on-Tyne.

This consists of a waistcoat-front combined with an ordinary shirt.

289. Patent Lignite; D. J. Walton & Sons, Haughton Dale Works, Denton, near Manchester.

This composition is a combination of resins and fibrous substances, and is remarkable for hardness, polish, and durability. It is applicable for various purposes, amongst which may be named furniture fittings. The polish is natural, no surface layer of polish being applied; it is also perfectly waterproof when laid on wood, cloth, &c. Specimens of various articles made of this material are exhibited.

290. Patent Method of Wrapping Needles; Richard Bennett, Redditch, Worcestershire.

291. Double Spring Hooks and Eyes; G. F. Parnell, 27, Buckland-street, New North-road, N.

In these hooks and eyes, the ends of wire, forming the ears of the eyes, are made to pass over the back of the eye and act as springs on the back of the hook when in the eye, and so hold it in its proper place. The ends that cover the eye are planished inside to facilitate the introduction of the hook.

292. Patent Compressed Tooth Powder; Arthur Dunn, Dalston.

This powder is compressed in an iron mould, and is protected by a metallic covering from the action of moisture, &c.

293. Bowler's Mechanical Boot Stretcher; J. Sparkes Hall, 308, Regent street, W.

This is an arrangement for stretching a boot at several distinct points, as shown in the annexed woodcut. The bosses by which the stretching is effected are forced outwards by a screw acting in the interior of the last.

294. Patent Brown Enamelled Leather Boots; Bowley and Co., Charing Cross, W.C.

These boots are specially intended for use in hot climates.

295. Patent Self-supporting Stocking; Frederick Ayckbourn, 4, Lyon's-inn, Strand, W.C.

For these stockings the garter, which is in the first place made separately and expressly for the purpose, is afterwards incorporated into the stocking in the process of manufacture.

296. Patent Swimming Propellers; John Cox, Edinburgh.

This propellor is to be attached to the leg, and acts upon the principle of the webbed feet of aquatic birds, collapsing when drawn up, and expanding when pushed against the water.

297. Double-Revolving Electro-Plated Fish-Hook; W. H. Box, M.D. Exhibited by Thomas Hemming and Son. Victoria-place, Redditch, Worcestershire.

The peculiarity of this hook consists in the application of a double swivel to the box to which the hook is directly attached by means of a knob, or pin-like head, so that it turns round without slipping through the box, while the upper part is completed by the usual round eye, or one of an elongated figure fitted with a spring, which, thus combined, allow the hook to make a double revolving action. It is also electro-plated with silver, and its appearance is rendered so attractive in the water, that it has been found to take certain fish without being baited. The hook is also supplied with a nuzzle of brass wire, of thirteen or fourteen inches in length, on the top of which is another swivel like the former, with a round eye for attaching the line, and with its lower end turned up in the shape of a noose, by which means it may be slipped off or on to the hook with perfect ease.

298. Parchment Address-band for Carpet Bags; W. H. Merle, 20, Princes-terrace, Hyde-park, S.W.

On the card-plate or frame, either of brass or leather, the permanent address is written. At each end of this, and under the frame which holds the card, are two openings, through which a slip of parchment is passed, upon which any number of addresses may be written, and by drawing along the band these may be shown as required.

299. Patent Fibre obtained from Wood, and Paper made from it; J. C. Martin, Fern-cottage, Charlewood-road, Putney, S.W.

This fibre is manufactured from short or waste ends of wood. The three varieties of paper exhibited are made wholly from the fibre without the removal of the short pieces which it contains, and without the admixture of any other description of pulp or size, the natural resin contained in the wood being so treated as to form size.

300. Specimens of Plastic Wood, or an improved description of Papier Maché; J. C. Martin.

The specimens shown are an inkstand, a mask, a corner piece, a bracket, and a book cover. This substance is stated to be applicable as a substitute for wood carvings, as it admits of being moulded to any required form. It can also be worked or polished similarly to wood, and can be so treated as to resist moisture. It will not warp by exposure to heat.

301. Specimens of Fibre, Paper, Card, Mill-board, and Pulps; W. G. Plunkett, and John C. Bower, C.E., 4, Belvidere-place, Dublin.

The specimens exhibited are the following—1, Handmade paper, card, and pulp of the "Iris pseud acorus" or common yellow flagger; 2, Washed fibre of the "Lavatera Arborea" or tree mallow; 3, Hackled hemp from do.; 4, Pulp of fibre or hemp; 5, Card and boards made from the wood of the "Lavatera Arborea;" 6, Millboard, from the small branches of the "Lavatera Arborea;" 7, Card from fibre of Lavatera Arborea; 8, Boiled and "washed fibre of the Bine" of the "Humulus Lupulus," or common hop plant; 9, Pulp made from do.; 10, Paper, card, and board from do.; 11, Pulp, paper, card, and board, made from the "Trifolium Rubens," or red clover; 12, Fibre of the "Iris pseud acorus," or yellow flagger. The foregoing unsized specimens have all been handmade. The "Iris pseud acorus," or common yellow flagger, is indigenous to Great Britain and Ireland. It produces, from the dried plant, from 60 to 70 per cent. of a strong fibre, (No. 12.) The "Lavatera Arborea," or sea tree mallow, produces a large quantity of fibrous matter, and, if properly cultivated, might, in the opinion of the exhibitor, be the means of turning the vast tracts of bog and waste lands in Ireland to a valuable account.

302. Improved Paper File; J. Faulkner, 62, St. Martin's-le-Grand, W.C.

This file is to be screwed against a desk or partition. The improvement consists in the addition of the upper horizontal guard of brass, for the prevention of accidents.

303. **Patent Glass Birdcage; F. Ayckbourn, 4, Lyons Inn, Strand, W.C.**

DRAWINGS.

310. Patent Syphon Smokeless Air Furnace; Major Vandeleur, R.A., Royal Arsenal, Woolwich, S.E.

The fireplace of this furnace in its longitudinal section much resembles an inverted syphon. The coal is thrown on at one end of the syphon, and the flame drawn out at the other. Two currents of air are made to pass diagonally through the fire, and uniting at the lower point of the arch, form an intense and perfectly smokeless flame.—(See *The Times*, March 2nd, 1858.)

311. Patent Conical Flue, and Double Chimney Steam Boiler; R. Morrison, Ouseburn Engine Works, Newcastle. Exhibited by W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C.

312. Improvements in the Generation of Steam, &c.; George Scott, Philadelphia, U.S. Exhibited by Galloway and Sons, Manchester.

This invention consists in injecting into a heated metallic vessel atmospheric air and water commingled, the water in the form of spray. This is stated to produce a greater amount of mechanical power with a given quantity of fuel than steam generated from water alone.

313. Slide Valve.; Charles Botten and Son, Crawford Passage, Clerkenwell, E.C. See Model, No. 20.

314. Patent Indicator for Registering Pressure; Thomas Baldwin, Corn Market Buildings, Bury, Lancashire.

By this instrument (Figs. 1 and 2) may be ascertained whether the engine has a constant or variable velocity, or a constant or variable pressure acting on the piston. The action of the governor of the indicator upon the measuring apparatus is such as to cause it to measure a pressure proportionally *greater* when the velocity increases, and proportionally *less* when the velocity decreases, than the true pressure which is measured when the velocity is constant. The sum of these pressures being multiplied by the constant velocity (the velocity at which the instrument measures true pressure) will give the force exerted by the engine during the time it has been in motion. The shaft T is connected to the registering apparatus for mean pressure, and the shaft O to that for indicating the revolutions. The dotted lines show the position taken by the instrument when the pistons move up or down. Figs. 3 and 4 represent an instrument for registering pressure without the use of springs. When the steam from the engine enters the cylinders of the instrument, the cylinder which receives the greatest pressure will have its piston moved in an upward direction, at the same time the float attached at the same side of the centre of the beam will move also in an upward direction, but the other piston and float will move in a downward direction. The mercury contained in the vessel wherein the float moved upwards will descend, whilst the mercury contained in the other vessel will ascend; and the column of mercury above the bottom of the descending float will be greater than the column above the ascending float; and the difference between the height of the two columns multiplied by the area of the bottom of the float C, and by the distance of the centre of the cylinder from the centre of the beam, will be always equal to the difference of the pressures acting in the cylinders, multiplied by the area of the piston A, and by the distance of the centre of the float on the other side of the beam centre. If the greater pressure be put into the other cylinder the operation will be reversed. The last-named instrument may have the measuring apparatus of Figs. 1 and 2 attached. Each instrument is adapted to take diagrams from the cylinder of the engine.

315. Patent Speed Regulator; Biggart and Loudon, Dalry, Ayrshire. Exhibited by W. and J. H. Johnson.

316. Mercurial Alarum Steam Pressure Guage; J. G. Jones, 2, King's-parade, Chelsea, S.W.

This invention consists in so constructing mercurial steam pressure guages that they shall give an alarm at any desired pressure; and in preventing the waste of mercury by its being blown out of the tube by any sudden increase of pressure in the boiler, as is often the case with the guage now in use; and also in preventing water accumulating on the surface of the mercury, which gives a false indication. The drawing shows the manner in which this is accomplished. Figure 1 is a longitudinal section. A is a bent tube (the same as that composing the common guage), which is bolted to the boiler at A^1. The tube (A) communicates with a vessel or receiver (B) by means of a branch pipe (B^1), on to which the graduated scale (C) is screwed, closing its end, and thus preventing any water getting into the tube (A). It will be seen that, should the pressure of steam in the boiler exceed the weight of the column of mercury in the tube (A), the mercury will be forced out of the tube into the vessel or receiver (B), leaving a free passage for the steam from the boiler to the whistle (D), as shown in Figure 2, which will give an alarm, calling the attention of the engineer to the state of the boiler. The instrument can be readily re-adjusted, by opening the cock (E), and allowing the mercury to flow back into the tube (A).

317. Patent Fluid Pressure Regulator; Guest and Chrimes, Rotherham. Exhibited by W. and J. H. Johnson.

318. Patent Steam Engine; Thomas Moy, 1, Clifford's-inn, E.C.

In this engine, the boiler is of tubes of small diameter, and consequently of great strength. The water is pumped into the tubes, and the heat applied externally. The heated water is kept in constant circulation on the well-known Perkins' system. No steam is allowed to form in the boiler, the pressure being kept so as to prevent the formation of steam in the boiler, at whatever temperature it may happen to be working. The cylinder is furnished with a jacket, in which the water circulates, and this jacket, as well as the valve box, is always in communication with the boiler, the circulation being uninterrupted, whether the engine is at work or at rest. The valves are so formed that the attendant can regulate the power of the engine at pleasure. The valves measure off and deliver to the cylinder, each time they are reversed, a certain quantity of highly-heated water, which will turn into steam, partially upon its entry, and partially after it has entered the cylinder. It is well-known that the sensible heat and the latent heat of steam, at any pressure, being added together, amount to 1,212°; therefore, the higher the sensible heat, the smaller is the quantity of latent heat. Suppose, then, a certain portion of water to be delivered to the cylinder, at the commencement of the stroke, at 1,000°, almost all this water will become steam of very great pressure; no more water being allowed to enter, this steam will drive the piston with a constantly diminishing force. But the remaining quantity of water will require to be turned into steam before the end of the stroke. This will be accomplished by the heated jacket of the cylinder, because, in con sequence of the continued expansion of the steam, the heat of the jacket will be far higher than the attenuated steam would require, and the whole of the water becomes steam before the completion of the stroke of the piston. The steam, after having performed its work in the cylinder, passes into a surface condenser, to be re-converted into water, and pumped back into the boiler. A self-acting apparatus keeps the boiler always properly filled with water.—(See the *Mechanics' Magazine*, Feb. 6, 1858.)

319. Patent Steam Engine Blower Pump and Meter; Robert Barclay, Montrose.

Steam enters by the sliding abutment C (Fig. 1), which is divided into two compartments, and is conveyed, through a slot in its upper side, into the working chamber formed betwixt the outside fixed cylinder A, and the uppermost side of the rolling cylindrical piston B. The exhaust steam escapes by a slot in the lower side of C. A (Figs. 1 and 2) is a fixed metal cylinder truly turned inside, resting on the metal platform K. B (Figs. 1 and 2) is a metal cylinder, truly turned outside, and on the projections on the inside; it is free to roll around the inside of the fixed cylinder A. The plain rollers D, D^1, and D^2, roll upon the projecting parts inside B, and being keyed upon the main shaft F by the bracket E, (Fig. 1), they keep the rolling piston B tight against the fixed cylinder throughout the revolution. D is a double roller (Fig. 3). D^1 receives the pressure of the steam, and communicates the power to the main shaft, causing it to revolve. D^2 steadies and reverses. The end covers, H and H^1, (Fig 2) are required to complete the steam working chamber. H^1 is adjusted in its pressure upon the end of the rolling piston by sets of screws in pairs, working on the circular piece J; one screw of a pair pinches the cover down while the other draws it up, thus the most perfect freedom of movement consistent with steam tightness is attained for the rolling piston. The sliding abutment C, which divides the fresh from the exhaust steam, is kept tight against the side of the rolling piston B, by steam having access to the small chamber on its head. F, the main shaft, runs in bearers on the metal platform. As a blower pump or meter the mechanism is greatly simplified. The movement of this engine is perfectly smooth, the whole mass moving in one direction. A rubbing point on the end of the rolling piston makes a very short travel, about 13 inches per revolution, as compared with about 50 inches in an ordinary reciprocating engine of same power. It can be so arranged that a rubbing point shall not pass over the same line in many thousand revolutions; unequal wear of the rubbing surfaces is thus saved. Friction is reduced to the minimum by adjustment of the end cover. A very high speed can be attained without the loss of power attendant on a heavy reciprocating body moving at a great velocity. Two of these engines bolted together, actuating the same shaft, are said to give out precisely the same power at every point of the revolution.

320. Patent India-rubber Accumulators, as applied to Boring Rods; R. E. Hodges, 44, Southampton-row, Russell-square, W.C.

The drawing shows a "compound accumulator," composed of 60 "simple" accumulators, held together by a pair of shackles. Each of the 60 is ¾-inch diameter, 18 inches long, and equal to 56lbs. when stretched to 7½ feet. Any portion of the 60 accumulators can be used in the shackles, to suit the weight of the rod, but when the whole 60 are attached, the power of four men will work a rod of 30 cwt. through an 8-inch stroke. They are also useful for a cable and towing spring, and for driving machinery, &c., &c.

321. Morris's Patent Improvements in Joining, Securing, and Supporting the Rails of Railways. Exhibited by F. W. Campin, 156, Strand, W.C.

The arrangements shown by the drawing exhibited consist of what the inventor terms "high-backed chairs," on which the rails are secured. In the two arrangements shown at the foot of the drawing, the securing the rail to the chair is effected by screws passing through the "high back" or ridge of the chair, the rail, a side-plate, and nut, a key or wedge in the lower part of the chair being added for ensuring a firmer joint. In the arrangements shown by the figure at the top of the drawing, although the chair is a "high-backed one," somewhat similar to the others, it has no screws or nuts for securing the

rail in the chair, the plan here adopted being to bring two ends of rails together in the chair, and to drive up tightly the peculiar-shaped key or wedge shown.

322. Patent Railway Chair; R. J. Badge, Manchester.

See Model, No. 43.

323. Railway Crossings; Irlam and Bethell, Gibraltar Iron Works, Manchester.

The crossing is constructed of a compound cast-iron chair, that portion of the wing rail upon which the rails can never run being cast to the same. Those parts which are subject to all the wear and tear are square bars of iron, steeled on the surface, and being short pieces inserted firmly in the chair, offer great facilities for steeling. These pieces, when worn down, are easily taken out, and at a small cost re-steeled.

324. Railway Turntable; Irlam and Bethell.

This invention consists, first, in making the outer or guard of wrought-iron plates, instead of cast-iron; secondly, in rivetting or otherwise attaching chairs to such guard, to support the annular rail for the turntable to revolve upon, or in attaching the rail to the guard by other means; thirdly, in making the platform or revolving part of the turntable of an outer ring, connected by wrought-iron girders, which girders support the chairs for the cross rails.—(See the *Engineer*, 21st August, 1857.)

325. Railway Turntable; Irlam and Bethell.

This turntable is constructed principally of wrought-iron, and when not required to be turned rests on a solid bearing, immediately under the line of rails on which the trains run; and when required to be turned, the centre is raised by a few turns of the handle, so that the weight is supported by the centre pin; this is steeled and hardened, so that the friction in turning a heavy weight is very slight. By turning the handle the contrary way, the centre is lowered, and the table rests upon its solid bearing, and is then as firm and steady as the permanent way.

326. Patent Railway Turntable; Thos. Richardson and Sons, Hartlepool Iron Works, Durham. Exhibited by W. and J. H. Johnson.

327. Patent Railway Brake; J. Sutherland.

See Model, No. 63.

328. Patent Bedplate Iron Solid Sleeper Permanent Way; Thos. Wright.

See Model, No. 50.

329. Lighthouse and Sea-coast Mariners' Refuge; J. S. Morris, 8, Earl-street, City, E.C.

The foundation of this building is proposed to be of wrought-iron piles, the superstructure being in the form of a cone, formed of wrought-iron bars, crossing each other diagonally, and forming a trelliced conical structure of great strength, and offering but little resistance to the waves. The dwelling and light apparatus is cylindrical, and suspended in the frustum of the cone in such a manner as to retain its perpendicular position, under an alteration of that of the cone to the extent of 15 degrees.

330. Bell Buoy; George Chowen, Marystowe, near Launceston.

This buoy is so constructed as to be susceptible of the slightest motion of the waves, and in rough weather the bell will be continually ringing. The inventor proposes that buoys of this construction should be placed near the Goodwin Sands for the prevention of casualties.

331. Straight-timbered Ship, with Diagonal Planking; T. S. Henzell, Howdon-on-Tyne.

In this arrangement the timbers are almost entirely straight, with diagonal planking of the whole height of the vessel. This is stated to afford increased strength.

332. Patent Iron Masts; Finch and Lamport.

See Model, No. 116.

333. Patent Perforated Paddle-wheel Floats; H. D. Deane, 18, Pigot-street, East India-road, Limehouse, E.

See Model, No. 113.

334. Adjutant Helm; Colonel Daniell, Donington-park, near Derby. Exhibited by John Gedge, 4, Wellington-street South, Strand, W.C.

This invention affords a means of communication from the bow of a vessel with the steersman at the helm. The apparatus consists of an upright revolving shaft at bow and stern, connected by an endless chain. The index on the bow dial being set to a given point of the compass, the same point is unerringly and instantaneously indicated on the stern dial, and the steersman changes the course of the vessel to the given point.

335. Patent Windlass; G. D. Davis.

See Model, No. 122.

336. Patent Ships' Capstan; W. Cunard, Halifax, Nova Scotia. Exhibited by W. and J. H. Johnson.

337. Improvements in Chains for Cables; E. Edwards, Abenbury Forge, Wrexham.

In this chain the links are formed so that the pile or fibre of the iron will run longtitudinally round every link so as to obtain uniform strength throughout. To insure this it is proposed to roll the bars of iron oval or slightly flattened on both sides, so as to indicate the top and bottom

of the pile of iron. A strong spring stud is used, which is lighter than the solid stud, and has the advantage of giving the chain considerable elasticity.

338. Patent Military Tents; Capt. G. Rhodes.

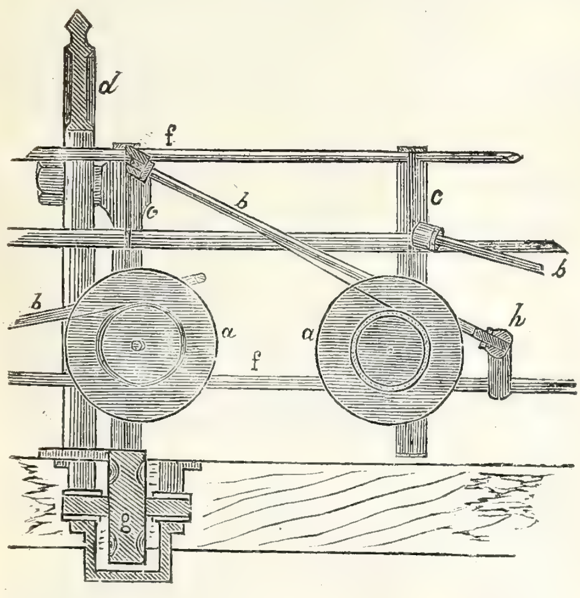
See Model, No. 136.

339. Improvements in Founding Submarine Works; J. R. Winder, Admiralty Pier Works, Dover.

340. Patent Rope Machine; Archibald Smith.

The peculiarity of this patent consists in the angular position of the frames containing the reels, by which means much useless friction on the wire is avoided, by its being brought directly to the periphery of the revolving frame, and the length of the machine considerably reduced. Fig. 4 is a longitudinal section of one reel frame, &c.—A, reel; B, frame; C, ring or disc; D, guard frame; *f*, tubular distance pieces between each ring or frame; G, roller supporting ring C; *h*, bearing for end of frame *b*. The wires or strands pass from A through hollow ends of frame *b*, and ring C, and through holes in each ring till it reaches the foremost one, thence to the laying plate, as in the machine above described. The bobbins being hung below the centre of their frames, are prevented from being carried around by the revolution of the frame. (See Model No. 104.)

Fig. 4.



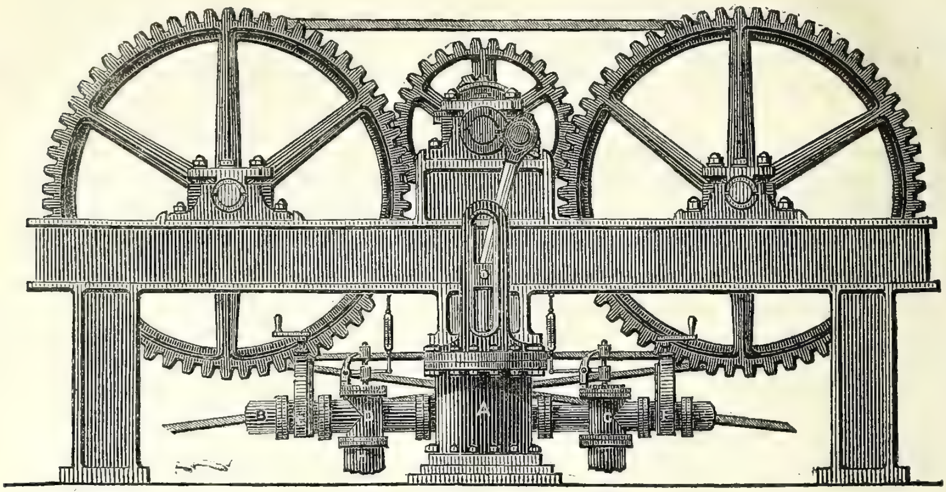
341. Patent Rope Machine; Archibald Smith.

This invention relates to the manufacture of flat wire ropes, and is divided into three distinct operations. 1stly. The manufacture of a right and a left-hand strand or rope by one machine. This is accomplished by the machine. Figures 1 and 2 having in each compartment two reels, the wires or strands from one set being led towards one end, and those from the other set towards the other end; also by having a laying plate, &c., at each end, and a double draw-off apparatus, the method of mounting the frame or friction rollers being similar to the above-described machine. 2ndly. The laying up of the required number of round ropes, and simultaneously stitching them together, so as to form a flat rope. Figures 1, 2, 3 and 4, sheet No. 2 (drawing), are a side elevation plan and end views of the machine for that purpose, which consists of six horizontal laying machines, mounted in frames, and geared together, so that each alternate machine revolves to the right and left hand. The strand being placed on the reels, F. G. H, are led from the machine to a frame, *m*, where they are spread asunder in such a manner as so permit the passage of a reel, Q, which is passed from one side to the other every quarter turn of the machine, thus stitching the round ropes together to form a flat rope. X is a draw-off apparatus, working in connexion with the machine. Figures 23, 24, 25, 26, and 27, represent another modification of the machine, the arms being substituted for the frame, *m*. Figures 3, 7 and 9, show a machine for unlaying, stitching together, and laying up round ropes previously made. The round ropes are wound in reels, and the ends opened and passed through the frame, *m*, as in figures 1 and 2, the stitching and drawing-off apparatus being similar. (See Model No. 104.)

342. Improvements in Apparatus for Paying-out and Drawing-in Electric Telegraph Cables; Benjamin Beale, 7, Lambton-terrace, East Greenwich., S.E.

The improvements consist of an arrangement of machinery that will act as the retarding apparatus, when paying out the cable, by forcing or drawing, or by forcing and drawing air, gas, water, or any other fluid, which apparatus will act as the motive power engine for hauling in the cable, when the pressure of steam, air, gas, water, or any other fluid is applied for such purpose. The woodcut represents a front elevation of a machine constructed with two pairs of grooved pulleys, having the cable wound round them. A is a cylinder, fitted with a metallic piston and a slide valve, the latter wrought by an eccentric, similar to a full pressure non-condensing steam-engine. Three of these engines are preferred in connexion with the same crank shaft, with the cranks set at equal angles with each other, to insure steadiness of action. B is an inlet pipe, in connection with a small air vessel at H, and, in common with the three cylinders, fitted with a stop valve C, and vacuum valve D, having a lever and a Salter's spring balance attached. E is an outlet pipe, in connection with a small air-vessel at I, and in common with the three cylinders, having a stop valve F, and escape-valve G, also fitted with a lever and a Salter's spring-balance; this outlet pipe is connected with a suitable boiler, which is to supply steam when the apparatus has to be used for hauling in the cable. The motion of the machine is given by the running out of the cable, which turns the wheels with the shafts and cranks, which, through the intervention of the connecting and piston rods, give a reciprocating motion to the pistons, drawing air (the stop valves being closed) into the vacuum valve

D, and forcing it out through the escape valve G. If the vacuum and escape valves be open, the strain on the cable will be but little more than that due to the friction of the machine.



343. Apparatus for Paying-out Submarine Telegraph Cables; L. Gisborne and H. C. Forde.

See Model, No. 106.

344. Buenos Ayres Gas-works Retorts (W. Bragge); E. T. Belhouse and Co., Manchester. Exhibited by W. and J. H. Johnson.

345. Patent Gas Top; W. Oakes, 115, High-street, Stockton-on-Tees.

In this invention the gas is collected and conveyed away from the centre of the furnace instead of from the side, as is ordinarily the case.

346. National Gas Apparatus; J. T. B. Porter, Lincoln.

See Model, No. 80.

347. Patent Reciprocating Drilling Machine; Batho and Bauer, Salford, Manchester.

This machine is intended for drilling cotter-holes in connecting rod ends, key-ways in shafts, and a variety of similar kinds of work, as well as for drilling and boring generally. The spindle being so near the face of the cross-slide, great steadiness is obtained, and the enlargement of the ends of the slots is avoided. The space being clear between the uprights, large objects can be admitted. The table is of the telescopic form, and is easily raised or lowered, and has a transverse slide at right angles to the cross-slide; it can be removed altogether out of the way for large work to be fixed on the baseplate. The working parts are readily adjusted, being easy of access.

348. Patent Moving Cylinder $6\frac{1}{2}$-ton Steam-Hammer; John Condy, Gowan Bar Iron Works, Glasgow. Exhibited by W. and J. H. Johnson.

This hammer is designed for forgings of the largest class.

349. Patent Blowing Engine; Edwin F. Jones, Redcar.

A 50-inch blowing cylinder is placed upon two side framings, with 18-inch steam cylinder above, and discharges 6,500 cubic feet of air per minute. The annular casing around the blowing cylinder works in equilibrio, being carried by the pressure of the blast acting upon the concentric ring cast on to the bottom of the blowing cylinder; the casing is driven by two side rods attached to crank pins in fly-wheels; hence, when the blowing piston ascends, the air in the cylinder above the piston is forced out through the upper ring of ports into the shallow chamber of casing (which has a constant communication with the air main), and from this chamber the compressed current escapes through a side port in the external face of the casing, and thence into the branch leading to the main. Whilst this is going on, fresh air is passing into the cylinder below the piston, through the uncovered lower ring of ports, and as the blowing piston returns, the converse occurs.

350. Method of Uniting Metallic Plates; John Coutts, Newcastle-on-Tyne.

This invention is principally applicable to iron shipbuilding, and consists in introducing an elastic substance into the joints, in conjunction with a peculiarly formed bolt and nut, the nut having a concavity on its face for receiving an elastic ring, and the bolt, a recess in its head, by which it can be turned.

351. Patent Winding Machine; Robertson and Orchar, Wallace Foundry, Dundee.—Exhibited by W. and J. H. Johnson.

352. Modification of the Jacquard Loom; Alfred Barlow, 25, Darley-street, Leeds.

The object of the present modification is to produce various twills, figured, designed, &c., by self-acting means, an outline only of the design being required, the repetition and combination of the twills, &c., being effected by the machine itself. This is accomplished, as shown in Drawing No. 1, by passing the horizontal needles of the Jacquard through vertical slots in the needle-board, and perforating the cylinder with two or more varieties of twills, &c., so placed on the surface of the cylinder that when the horizontal needles remain at the bottom of the slots they will be acted on by one variety of twill or satin only, but if all or any portion of the needles be raised in the slots, then they will be acted upon by any other variety of twill, &c., opposite to which they may be placed. The design is cut out of leather or other material of requisite thickness, and tacked to the surface of the pattern cylinder as shown. This cylinder is placed immediately under a set of vertical needles, through the eyes of which the horizontal needles are passed. When the pattern cylinder is raised, the design on its surface will raise the vertical needles above it, consequently one portion of the horizontal needles will be acted upon by one variety of twill, &c., and the other portion by another variety, and as the cylinder revolves slowly after each action upon the needles, the whole surface of the design will be acted upon in succession. Drawing No. 2 shows a section of an ordinary Jacquard power loom, to which the above system has been successfully adapted. By regulating the speed of the pattern cylinder, the design may be woven in any given "count" or relative proportion of warp and weft. The pattern cylinder shown (full size) is equal in extent to 450 cards, and the relative cost will be apparent from the two modes of producing the same design, as shown on Drawing, No. 1.

353. Patent Check Loom; M. A. Muir and J. McIlwham, Anderston Foundry, Glasgow. Exhibited by W. and J. H. Johnson.

354. Patent Dust Exhauster; C. Nightingale, Wardour-street, W.

This drawing exhibits the dust exhauster as applied to a rag breaker. It consists of a hollow gauze cylinder (from the centre of which the dust is exhausted) revolving over a delivery cloth. The objects which it effects are the removal of the dust, both from the rags broken and the breaker room.

355. Patent Machine for Glazing Paper continuously in the web or length; J. C. Martin, Fern-cottage, Charlewood-road, Putney, S.W.

This apparatus consists of a pair of metal cylinders or endless plates fitted loosely over ordinary glazing rollers, and which revolve with the motion of the rollers against each other, always presenting a continuous glazing surface to the paper as it passes between them. This arrangement of the glazing plates admits of the rollers being heated by steam, and the paper glazed of any required length. To prevent the creasing, a plate of metal lined with leather is fixed over about two-thirds of the circumference of the upper glazing plate, and over this the paper is drawn by the motion of the rollers before passing between the plates. The paper as it passes over the fixed plate is covered with a sheet of canvass. The object of this is to present a large fixed or resisting surface to the paper as it passes over the roller, immediately before receiving pressure.

356. Patent Brick-making Machine; R. Grey, Newcastle-on-Tyne. Exhibited by W. and J. H. Johnson.

357. Plan for Constructing and Arranging Roads and Ways for relieving the Traffic of London; Charles Baylis, 32, Poultry, E.C.

358. Machinery for the Cultivation of Land by Steam-power; Thomas Keddy, Handsworth, Staffordshire.

This drawing is to the scale of one inch to the foot. Fig. 1 is a side elevation of the machine; and its chief features are—1. A spring *a* over the guide wheel *b*, so that an equal pressure may be given notwithstanding inequalities of the soil. 2. An endless metallic platform, *c d*, extending the whole breadth beneath the boiler, presenting a surface to the earth of upwards of thirty superficial feet. There are large fluted rollers, *e f*, over which the platform *c d* moves, and small rollers, *g h*, press upon the platform, which give an equal bearing to that portion immediately in contact with the ground; it has a broad wheel, *i*, on each side, upon which, and the guide wheel *b*, the whole weight of the machinery can be raised by hydraulic or other power, and geared for turning upon new ground at the land's ends. 3. Vertical rotatory screws, or tillers, *k*, follow in a line, at right angles to the line of draught, and may be raised or lowered to any required depth. 4. An oscillating or zigzag harrow follows. There is a plate of iron, *l*, to which is fixed a number of prongs, *m*, and by drawing a lever these prongs pass through the fixed plate *n*, and are perfectly scraped. Curved prongs, *o*, collect the weeds or twitch, which may be deposited at pleasure by drawing forward the lever *p*. Fig. 2 is an end elevation of *k* in Fig. 1. Fig. 3 is a plan of *l n*, Fig. 1.

359. Archimedean Cultivator; J. James Cousins, Leeds.

This is an arrangement for working a cutter formed like an Archimedean screw, in advance of the ploughshare.

360. Patent Centrifugal Corn Dryer; J. C. Sinclair, Elgin.

In this apparatus the grain is deposited in a revolving chamber in such a manner that the stubble ends are next to the outside of the arms, whilst the tops or corn ends overlap each other so far in the middle as to keep the layers tolerably level, the damper samples being disposed at the parts nearest the extremities. When steam is at hand, a jet can be conveyed into a

perforated chamber in the centre of the apparatus, to aid in drying the grain as well by the direct steam heat as by the aerial current, which may thus be produced in contact with the grain. The aerial current can be rendered drier by causing it to flow over layers of muriate of lime, or other matter having a powerful affinity for moisture. By these means, and by using waterproof covers to protect the grain in transit from the drying machine to the stack-yard, and a temporary stage or canopy over the " steddle," stack building may safely proceed in the wettest weather.

361. Patent Hot Air Stove; Edwin F. Jones, Redcar.

In this stove the flame or gas passes (as shown in the Drawing) in the direction of the arrows, first through the holes in the arch above the fire-grate, into the body of the oven. After heating the external pipes the heat passes through the internal pipes of the top tier, thence down the flue, through the bottom tier, into the chimney. The air to be heated enters as the inlet divides in the cross main (see Plan), and passes between the internal and external longitudinal mains down the vertical branch, and likewise back through the bottom tier into the outlet, perfectly heated to the blast furnace. The advantages are stated to be — 1st. Double-heating surface, with half the weight of iron. 2ndly. Heating the air in strata. 3rdly. A saving of positive power, owing to the larger area of the air passages and few bends, and economy of fuel. At one end is fixed a metallic joint, to allow for any difference of expansion between the external and internal pipes.

362. Patent Three-wheeled Omnibus, with Self-acting Break; G. and W. Richardson, 2, Copenhagen-street West, Islington, N.

363. Patent Indicator for Omnibuses; Francis Parker.

See Model, No. 73.

364. Fin-expanding Canopy for Carriages, &c.; T. L. Scowen.

See Model, No. 76.

365. Bathing and Swimming Sandals; J. Davis.

These sandals are designed to protect the feet while bathing, and also to assist in swimming.

366. Patent Elliottype Photographic Process; R. Elliott, Newcastle.

The specimens consist of copies of oil paintings produced from glass negatives, with the lights of the pictures copied or traced on the surface with some pigment.

367. Patent Triangular Scales and Guages; R. E. Hodges, 44, Southampton-row, Russell-square, W.C.

The drawing represents a strip of wood or metal 10 inches long and 1 inch wide, with a diagonal cut severing it in two. Each inch is divided into 10, and the whole into 100 parts. Each move of the 10th of an inch of one triangle upon the other, whether backwards or forwards, must decrease or increase the width of the scale 100th part of an inch, and the scale will be parallel in the parts which overlap each other. The guage plate, Fig. 5, will give the diameter of needles, wire, screws, round iron, and lathe work, and also the thickness of paper, sheet metal, &c. Tubes (as gun-barrels) may be guaged internally from one end to the other by a simple arrangement of sections of these triangles.

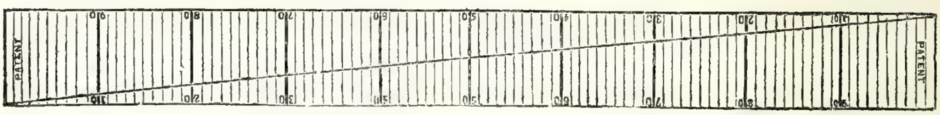
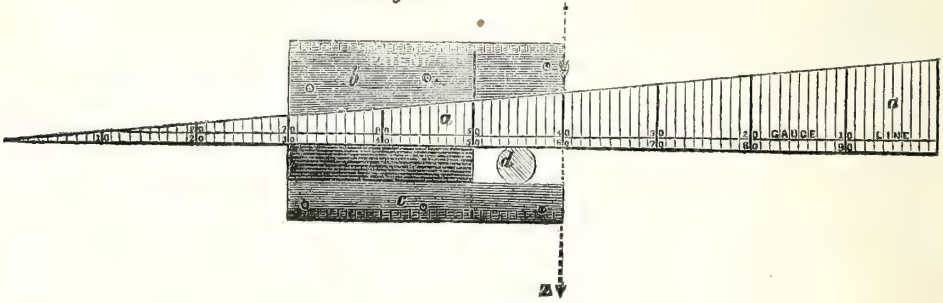


Fig. V



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